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Battelle Technical Review

IN THIS ISSUE : Space Research in Perspective

VIGNETTE

STAN J. PAPROCKI, JR.

In the years since the emergence of nuclear power, scientists and engineers have made great strides in dealing with resultant materials problems. Yet, according to Stan J. Paprocki, a leader in nuclear fuel-element technology, "We are only at the beginning of what is possible. We have only scratched the surface in our search for nuclear materials. Improved processing methods and enlarged knowledge of the nature and properties of materials will enable us to create metallic, ceramic, and plastic compositions far surpassing those now available. There are no limits to what we may accomplish except those imposed by our own ingenuity."

Stan joined the Battelle staff in 1947, after studies at the University of Illinois, leading to B.S. and M.S. degrees in metallurgical engineering. At the Institute, under the guidance of some of the earliest workers in the field, he has participated in the development of fabrication methods for clad core components including fuel, moderator, shielding, control, and structural materials. He has collaborated in studies of roll-bonding techniques and of gas-pressure bonding. He aided, also, in the preparation of the first 1-mil-thick uranium foils used in nuclear bombardment studies at the University of California.

Most military reactors today have benefited from research in which Stan has been a participant. The interests of Stan and his fuel-element development group have broadened with the years. They have developed reactor materials for liquid-, metal-, gas-, and water-cooled reactors and have conducted many component-design studies. Their recent research has included investigation of uranium nitride, carbide, and dioxide as fuel materials, and they have done much of the research necessary to establish the usefulness of those materials. Many cermet materials (in which nuclear fuel dominates) and dispersion materials (containing more metal than fuel) have been investigated exhaustively, and the usefulness of the refractory metals—including stainless steels, zirconium, niobium, and tungsten—in fuel-element technology has received much attention.

The group's pressure-bonding research has led to various developments. It has evolved techniques for bonding refractory materials such as niobium, beryllium, and graphite. Particularly noteworthy in the field of powder metallurgy, a gas-bonding method for densifying ceramic and metal powders has been developed. Moreover, Stan and his colleagues have brought to the production stage a pressure-bonding method for forming fuel elements for the PWR (Shippingport) Core 2. As an outgrowth of research on the use of explosive shock waves for forming, the group has come up with a method for compacting powders to densities approaching theoretical limits.

Along with his preoccupation with research, Stan is active in the American Society for Metals, the American Institute of Mining, Metallurgical, and Petroleum Engineers, the American Nuclear Society, and the American Rocket Society. He is author and coauthor of more than a score of papers and articles.

Stan and his wife Carole are kept quite busy by daughter Karen (8) and son Paul (4) and their fine home. Stan devotes much time to his flower garden and manages to get in some golf and swimming.

BATTELLE TECHNICAL REVIEW

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COMMENTARY

The Practice of Theoretical Physics

As is the case with the other exact sciences, the object of theoretical physics is to provide a coherent interpretation of the laws of nature and to foresee nature's behavior. Theoretical physics, however, differs from the other sciences in that it seeks to investigate the principles underlying laws and to create mathematical theories based on those principles. On the strength of these theories known laws may be derived and new laws foreseen.

A realistic definition of theoretical physics might state that it consists of the elaboration of models one can use to analytically reproduce the observed pattern of experimental relationships, and to predict new relationships. . . . a model is a representation of the total comprehension of the system under study. This representation can be concrete or abstract, according to the case, and the model can be exact or approximate according to one's ability to understand.

The invention of the model is the pre-eminently creative act of the theoretician. It is in this activity that he compares best with the artist.

Having invented the model there must follow its elaboration in the sense of mathematical formulation, since in theoretical physics an intuitive interpretation is not sufficient. One must subject oneself to this rigorous task of formulating one's model in a mathematical language, so that, as a result, the nature of this model is finally independent, or almost so, of the agent who formulated it.

The practice of theoretical physics leads us to speak about the relation of the theoretician with his colleagues, the experimental physicist and the mathematician. Let us begin with the experimental physicist, who discovers new effects and very often directs the theoretician's attention towards an unexplained phenomenon. Reciprocally enriching and stimulating, this relationship can be very fruitful. It may only last for a period of a few weeks to a few months, and may cover the "informative and inventive" phase of the theoretical process. Frequently a few weeks of such collaboration is enough to stimulate years of theoretical work.

The risk run by the theoretician in becoming enmeshed in calculations is parallel to the danger to the experimental physicist who loses himself in the difficulties of experimental technique. Now, though the theoretician must take care not to theorize in the limited sense of the term, he also must not neglect his cultivation of mathematics, since mathematical methods and theories are in constant development, and their practical potential is unforeseeable. How, then, can he free himself from the worry of the rigorous mathematical expression of his subject? Well, mathematicians are there, ready to help him prove the correctness or incorrectness of his conjecture. It is only a matter of winning back their interest and of recreating a common language between them and himself.

Since the end of World War II the theoretician has had a new field before him: in addition to teaching and academic research, he can now turn to applied research or basic research in large nonacademic, private, national or international laboratories. In these laboratories, the theoretician *must* take an active part in the guidance of experimental investigations. Is he trained for this task? No, but he is aware that the question of his participation in the combined efforts of modern research is raised.

Philippe Choquard, Battelle-Geneva, from a lecture at the Physical Laboratory of the University of Lausanne.

Space Research in Perspective

Placing man-made objects in space is a new and costly accomplishment. The author considers what the value of this development may be to science, defense, and society.

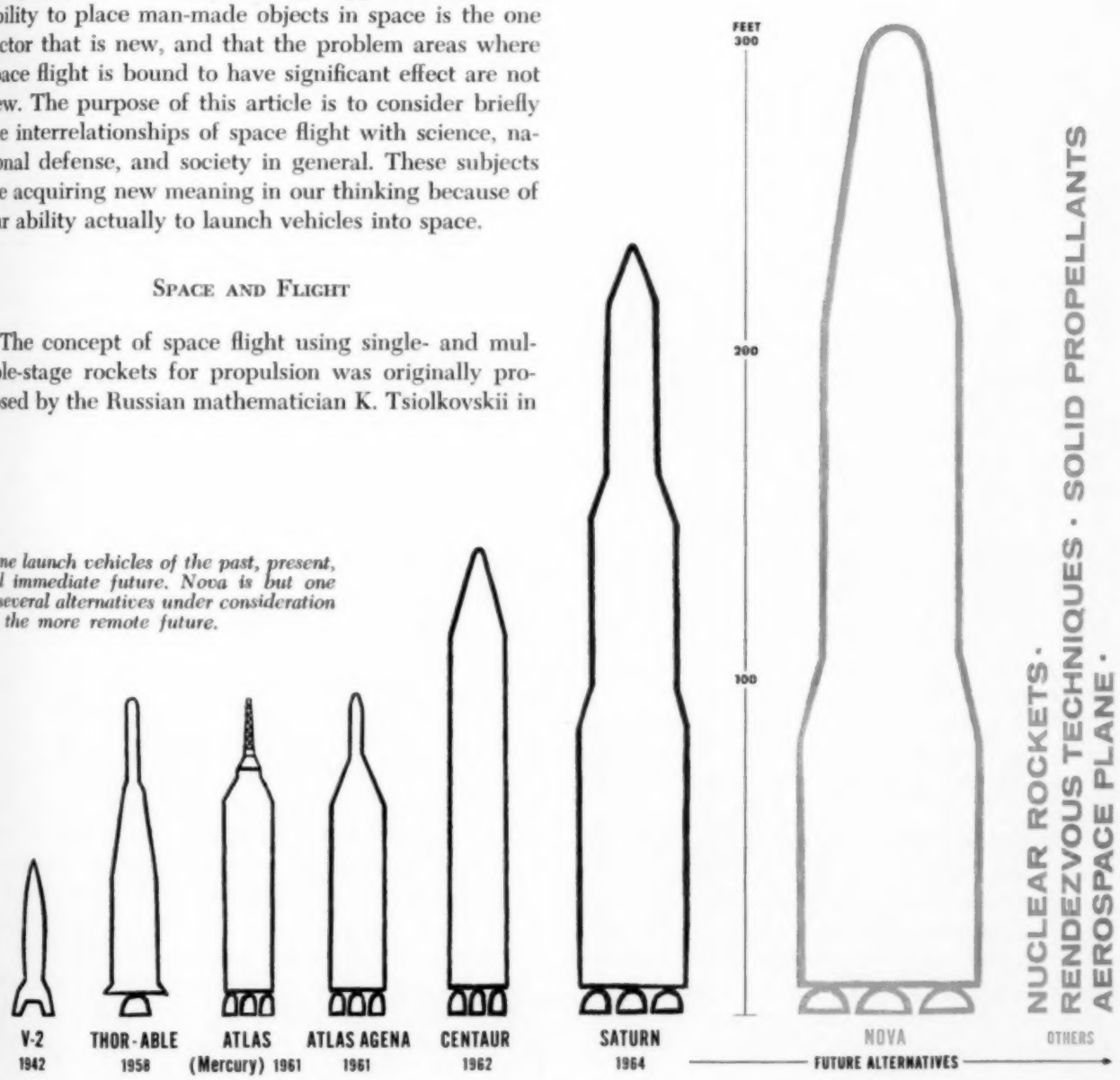
by FREDERICK L. BAGBY, JR.

IN THE PAST 5 YEARS, matters which previously had been the province of a few scientists, engineers, and science fiction writers have become of great popular interest. The recent successes in sending a man into space and safely retrieving him have raised this interest to a new level. At the same time, the increasing effort required by these developments has forced a more sober appraisal of the situation. As human beings we are all faced with major questions and responsibilities in determining the role we want our society to play in this latest adventure of man.

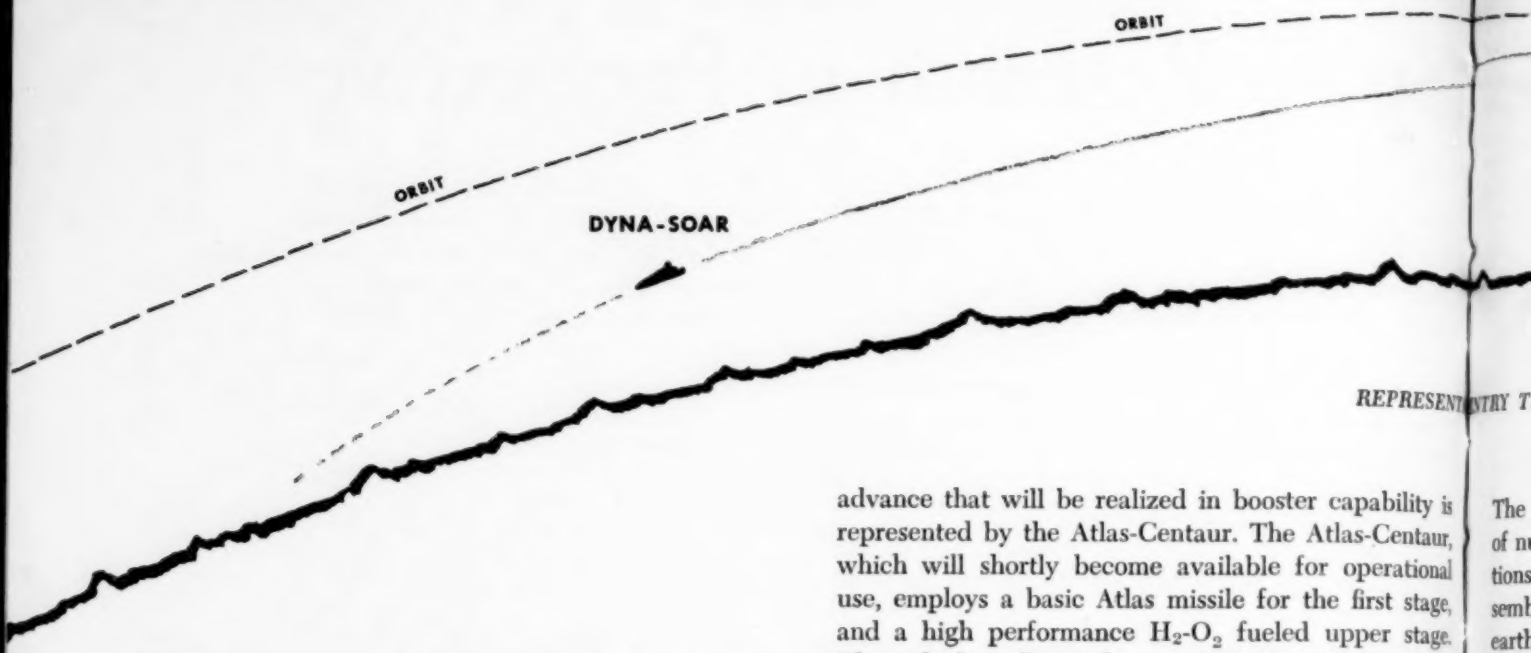
If the present situation is viewed in historical perspective, it is immediately apparent that the ability to place man-made objects in space is the one factor that is new, and that the problem areas where space flight is bound to have significant effect are not new. The purpose of this article is to consider briefly the interrelationships of space flight with science, national defense, and society in general. These subjects are acquiring new meaning in our thinking because of our ability actually to launch vehicles into space.

SPACE AND FLIGHT

The concept of space flight using single- and multiple-stage rockets for propulsion was originally proposed by the Russian mathematician K. Tsiolkovskii in



Some launch vehicles of the past, present, and immediate future. Nova is but one of several alternatives under consideration for the more remote future.



1903. Considerable pioneering work on the development of practical rocket engines and vehicles was done on a private basis by Goddard in the U.S., and by Oberth and his associates in Germany from 1910 to the 1930's. The usefulness of early rocket vehicles was limited by their low payload capacity. However, just as technology has increased the payload capability of aerodynamic vehicles during the years since the Wright brothers' first successful airplane, so has the same evolutionary process been occurring with the rockets essential for launching useful payloads from the surface of the earth into space. The first truly significant rocket vehicle, from the standpoint of being capable of carrying a useful payload and being controllable, was the German V-2, a military weapon.

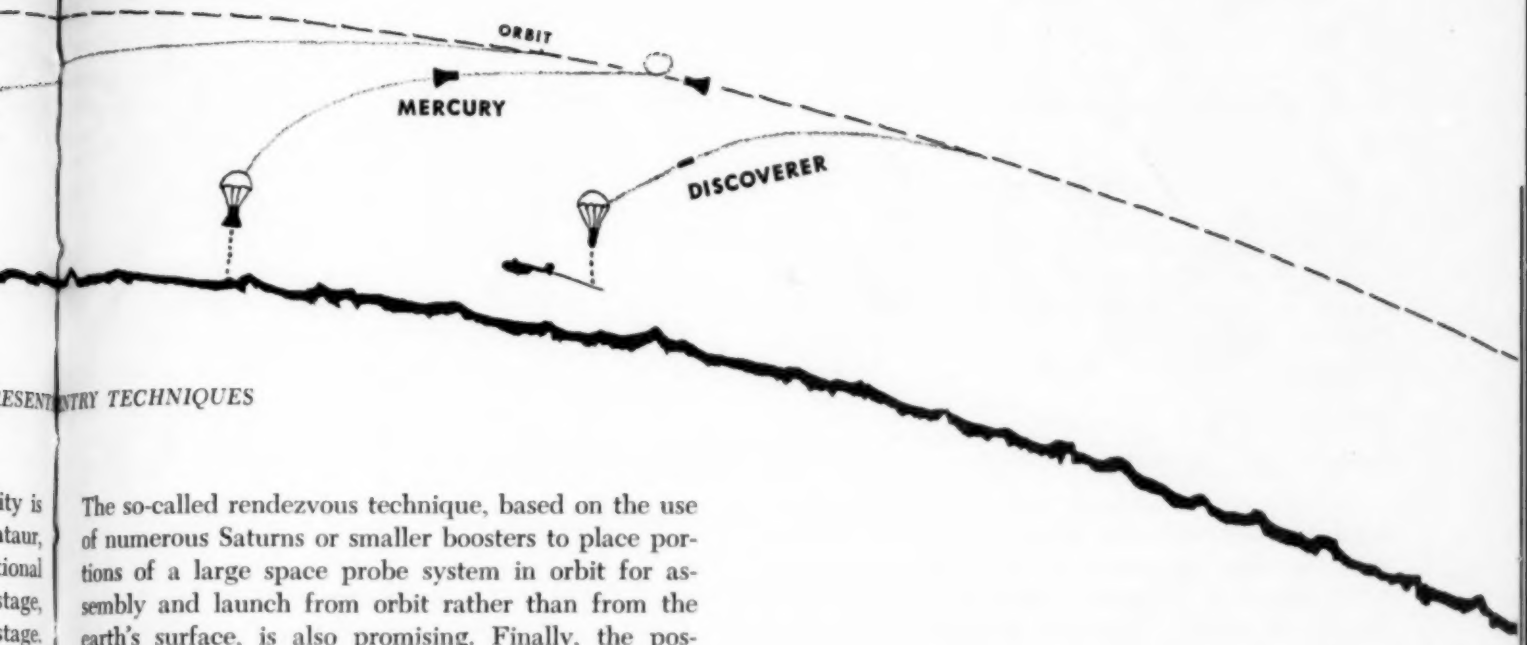
Some of the present and projected rocket booster capabilities programmed by the National Aeronautics and Space Administration (NASA) for the United States are shown on page 3. No detailed data are available on the Soviet boosters for comparison other than the general knowledge that they are larger and more powerful than those presently available to the U.S. The V-2 is shown in the figure as a reference point to permit comparisons from a size standpoint with some of our more recent and proposed future capabilities.

The Thor-Able vehicle weighs over 100,000 pounds and until just recently has been a "workhorse" for launching significant scientific payloads. It is capable of lifting several hundred pounds into a 300-mile, low-level orbit around the earth. Next is the Atlas missile booster which is being adopted in different configurations for several space missions, most notable of which is the Project Mercury series. The next truly significant advance that will be realized in booster capability is represented by the Atlas-Centaur. The Atlas-Centaur, which will shortly become available for operational use, employs a basic Atlas missile for the first stage, and a high performance H_2-O_2 fueled upper stage. The vehicle will weigh over 300,000 pounds on the launch pad, and will be capable of putting 8,000 pounds of payload into a 300-mile, low-level orbit.

The largest complete booster vehicle under development is Saturn, which is the fifth vehicle from the left in the figure. The Saturn first stage is a development based on the use of eight clustered rocket engines of the Thor type, and will have two or more upper stages based on the H_2-O_2 high-performance propellant combination. The total vehicle, with three stages as now planned, will weigh something over 1,000,000 pounds in launch configuration, and will be capable of putting about 20,000 pounds into low-level orbit.

On the right-hand side of the figure are shown or listed several advanced concepts for future booster systems which will increase payload-launch capacity several times above that of Saturn. Considerable publicity has been given to the Nova concept for which active development work is currently in progress on a new rocket-thrust chamber having a thrust of the order of 1,500,000 lb., nearly 10 times the size of present thrust chambers. The Nova concept represents essentially a scaling up of the Saturn approach to high payload boosters using clustered thrust chambers.

A number of alternatives to the Nova concept are also currently receiving extensive preliminary design attention. Underlying the requirement for all advanced large payload booster systems is the need for achieving greater economy than is now possible with expendable boosters or with recoverable Saturn first stages. Thus the multi-mission aerospace plane, which would have the capability of serving as a first stage booster and at the same time would be able to be flown back into the atmosphere for a controlled landing, is of interest.



ESENT ENTRY TECHNIQUES

The so-called rendezvous technique, based on the use of numerous Saturns or smaller boosters to place portions of a large space probe system in orbit for assembly and launch from orbit rather than from the earth's surface, is also promising. Finally, the possibilities of using solid propellants and nuclear rockets in combination with liquid-propellant stages for booster systems are other representative technical approaches that are at present incompletely evaluated. The present and potential programs for booster development represent tremendous and costly technological undertakings, but do not place any unusual demands upon our basic scientific capabilities. Rather, the problems are ones of great familiarity to all designers of flight vehicles, namely, the obtaining of higher performance through ingenious design, availability of better materials, and utilization of better fuels. The importance of reliability in such booster systems is overriding because of the large investments required, and because of the high cost of failure.

A second aspect of flight technology that must be mastered before our space-flight capability can reach full maturity is illustrated above. This is the problem of atmospheric entry and safe recovery of payloads that have been placed in space. Air catches of Discoverer capsules in the United States is one demonstrated accomplishment. It is also well known that the Soviets have successfully recovered orbital vehicles including one containing a man. The Mercury manned capsule represents a variation of the Discoverer technique in which the capsule is primarily slowed down by atmospheric drag, and then lowered to the earth's surface by parachute under conditions that have permitted survival of a man. A third concept is the lift re-entry approach which is being actively investigated as a part of the Dyna-Soar program. Still other concepts have been proposed, and as is the case with boosters, the ultimate system that may prevail is not yet clearly established.

Some of the instrumented capsules that have been placed in space for purposes of scientific investigation are shown on page 6. Their purpose is to define better the normal, the disturbed, and the extreme physical conditions existing at altitudes in excess of those that can be investigated by balloons. Both U.S. and Soviet vehicles are shown for size comparison. Also included in the figure are two advanced U.S. spacecraft now under active development, the Ranger for lunar orbit and hard landing and the Surveyor for lunar soft landing. All vehicles shown are intended to serve specified scientific purposes, and from the engineering design standpoint are limited in their function and expected useful lifetime.

A significant milestone in space flight will have been realized when large reliable boosters are available, when suitable entry techniques have been proved, and when the results of current scientific investigations of the nature of terrestrial and solar space have provided

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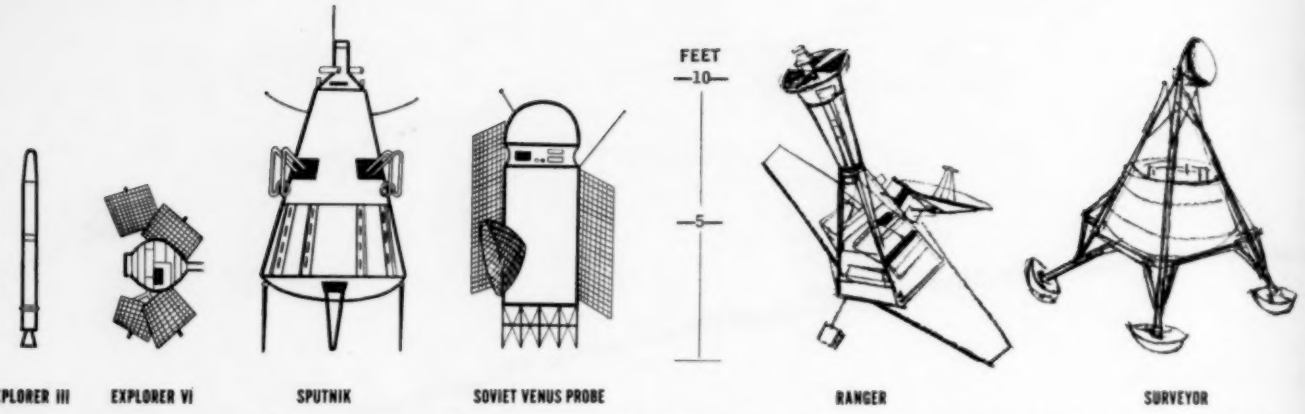
Frederick Bagby has been engaged in research programs associated with aeronautics and astronautics since the beginning of World War II. These have included studies at Battelle in the fields of aerodynamics, aircraft and missile engineering, flight-propulsion systems, and space technology. He has also supervised Institute research in combustion physics, thermodynamics, and fluid mechanics. During World War II, he collaborated in the development of equipment and power-plant installations for military aircraft. A member of the Structures and Materials Committee of the American Rocket Society, Bagby is author of the chapter "Materials in Space" in *Advances in Space Science*.



Typical unmanned space craft for scientific exploration. "Ranger" and "Surveyor" are being developed for hard and soft lunar landings.

definitive information for design guidance. At that point the next major phase of space flight will be the establishment of permanent orbiting vehicles and the conduct of large-scale manned interplanetary probes. Detailed design of equipment suitable for these more advanced types of space flight is highly uncertain since the technology required is not yet adequately developed. We need to know more about the performance of materials in space; we need to develop reliable light-weight, long-duration auxiliary power sources; and we need to accumulate knowledge of detailed requirements of equipment necessary for survival of man in space. These technological needs are presently under intensive investigation, and many promising new ideas have been evolved which should provide the required solutions.

Admittedly, it is going to take time and vast expenditure of resources to accomplish the relatively modest assignment of exploring only our solar system. The question we must address ourselves to is "Why should such programs be carried out and will they be worth it?" The answer must come from looking at those "old" problem areas previously listed in terms of the impact that space flight may have upon them.

Space and Science

From the earliest days of recorded history, man has pondered the mysteries of the earth, of the universe, and of life itself. Our new-found ability to accomplish space flight opens new avenues of experimental investigations of these still unresolved questions.

Already, as a result of the instrumented U.S. and Soviet space probes and satellites that have been launched, the amount of information within the scientific disciplines related to the aerospace environment has increased immensely. For example, data on the earth's upper atmosphere and near space have shown that the atmosphere extends further, has greater density at high altitudes, and varies more strongly than was believed from indirect observation and theoretical speculation. The techniques of mass spectroscopy and ion traps have shown the earth's atmosphere to extend almost 1000 miles and to be comprised mainly of atomic oxygen at altitudes in excess of 150 miles. The principal constituent of space between the earth and moon has been identified as protons or hydrogen ions varying in concentration from 10^5/cc to less than 10^2 ion/cc. Magnetic measurements have offered experimental support to the earth-core source theory for the geomagnetic field. Radiation experiments have produced valuable data concerning particle flux, energy flux, and energy spectrum of both solar and cosmic radiation in the earth-moon-Venus region; the Van Allen belts of trapped cosmic radiation found circling the earth are the most significant radiation discovery to date. Many other examples of new discoveries can be cited.

The table is a capsule summary of the major space-science experiments presently scheduled or planned by NASA in the 1960 - 1970 time period. The greatest emphasis in the programs is on the physical sciences. Many of the details of these programs are still in the formative stages, and will be dependent upon the development of suitable instrumentation and communication systems.

A substantial portion of the scientific research discussed can and will be done with unmanned, instrumented satellites and space probes. Nevertheless, man being the creature he is, the combination of curiosity and the challenge represented by space have already ordained that he himself will participate in some of these explorations. Hence, the importance of space in terms of the biosciences. Progress in this general area will do much to define the useful role of man in space.

Project Mercury represents the first United States program designed to investigate some of the biological problems of the survival and effectiveness of man during space flight. With Commander Shepard's successful flight, it is almost certain that more sophisticated experiments will be carried on to provide further knowledge about man's capabilities in space-flight operations. Such investigations will deal with physiological and psychological problems of man himself under unusual environmental circumstances, and the problems of ecological systems to sustain life during extended space flight. Project Apollo represents such a step beyond Project Mercury.

These tremendous vistas of scientific experiment that will be permitted by our space flight capability reveal horizons that will occupy our scientific energies for many years to come. In addition to the possibilities of opening up whole new areas in the physical sciences, there is the always intriguing question as to whether there are other forms of living organisms within our solar system, and as to whether the type of life that we know here on earth exists on other bodies in our universe.

Space and Defense

While, of course, the defense aspects of space technology are a basic part of any discussion of perspective in space research, the whole subject of defense and its ramifications is complex and interwoven with factors other than technological developments per se. Much has been written by experts and pseudo experts on this subject, and to dwell at any length on defense relationships is beyond the purpose of this article. Suffice to say that the effort of the government in space technology is both broad and deep, and that developments favorably influencing the nation's ability to defend itself are most certainly an essential part of this country's research effort.

SPACE SCIENCE PROGRAMS

General Field of Science	Definition and Scope	Space Flight Experiments
Geophysics	Concerned with earth-oriented phenomena such as geodesy, gravitation, meteorology, aeronomy, ionosphere and exosphere, radiation belts, cosmic rays, electromagnetic phenomena, geology, seismology, and geomagnetism	Sounding rockets Satellites (Explorers, Discoverers, Vanguards) Tiros & Nimbus, meteorological satellites Orbiting geophysical observatory Project Apollo (manned space laboratory)
Solar and Interplanetary Physics	Concerned with the nature of the Sun's energy release process, the solar-terrestrial relationship, corpuscular and electromagnetic radiation, solar flares, solar winds and the solar atmosphere, and inert matter in space	Sounding rockets Satellites, deep space probes Orbiting solar observatory
Lunar and Planetary Physics	Concerned with the characteristics and nature of the finite bodies making up the solar system; technical areas similar to those listed under geophysics	Pioneer deep space probes Ranger (lunar orbiter and hard landing) Mariner (Mars & Venus fly-by) Surveyor (lunar soft landing) Prospector (advanced lunar soft landing) Voyager (Mars and Venus orbit and land) Apollo (manned lunar fly-by and land)
Astronomy	Concerned with the origin, identification, and mechanics of celestial bodies. Includes stellar and interstellar astronomy, radio astronomy, meteor astronomy, positional astronomy, celestial mechanics, and moon and planet studies	Orbiting (optical) astronomical observatory Orbiting radio-astronomical observatory
Astrophysics	Concerned with the chemical and physical processes occurring within the universe including stars, galaxies, inter-galactic phenomena, and cosmic rays	Orbiting geophysical observatory Orbiting astronomical observatory
Biosciences	Concerned with the medical and behavioral sciences related to man in space, and with the problems of living organisms in extraterrestrial environments	Project Mercury Project Apollo

The impact of aerodynamic flight on military operations and national defense has already been tremendous within the short span of slightly more than half a century. Fundamental principles in military flight operations have always tended to place emphasis on being able to go higher, faster, and farther. Obviously space flight represents another order of magnitude increase in these parameters.

At the present time, and in all probability for at least the next few years, we are confronted with what has been described as the "delicate balance of terror" by Alfred J. Wohlstetter, of RAND. This situation exists because the ballistic missile represents an offensive weapon that presently is not neutralized by active defenses. Therefore, each of the two principal protoganists of opposing ideologies possesses the technique to destroy the other with ballistic missiles, and yet neither has the power to defend itself against these same missiles. Admittedly, passive defenses such as population dispersion and fall-out shelters can minimize the effect of ballistic missiles. Nevertheless, there is a distinct requirement for active defense systems against ballistic missiles, and against the submarines, ships, and aircraft which are capable of launching these ballistic missiles from areas close to our shores.

Our advancing space technology represents one of the few possibilities now known for achieving a successful ballistic missile defense. Already military programs based on satellites for (1) a missile defense alarm system (MIDAS), (2) general reconnaissance (SAMOS), (3) for navigational purposes (TRANSIT), and (4) for communications (ADVENT) are being actively pursued. The utilization of space satellites for active defense against both ballistic missiles and other satellite systems is also being seriously investigated, but as yet our technology is not sophisticated enough to indicate how this will be accomplished in a practical manner.

As was the case in the general field of science, it seems fair to conclude that our present and proposed space research programs and space-flight accomplishments bid fair to make a definite beneficial contribution in the long-standing problem area of national defense, at least to the point of neutralizing ballistic missiles. Then again the evolutionary development of measures and countermeasures in weapons will have passed one phase and be ready to enter another. In all likelihood space research will again be significant in this as yet undefined next phase.

Historically, military research eventually contributes beneficially both to science and society. Studies in space technology are likely to do the same. If true, one can expect that defense developments now going on will, in the long run, help solve the continuing problems of satisfying society's material wants and add to the scientists' store of knowledge.

Space and Society

One of the most difficult questions to answer is this: "In what way will space research and space flight benefit society as a whole?" Already illustrations have been presented to show probable benefits in the area of science and hopefully these in turn will ultimately be broadly beneficial to society.

Nevertheless, three-fourths of the world's population suffers today from substandard living conditions, a situation which consequently serves as the breeding ground for economic and political turmoil. Can or will space research provide the desired political stability, better food and housing, economic opportunity, and an answer to the rapidly developing population crises? A forthright answer would, at first glance, have to be, "No". Very powerful and compelling arguments can be easily advanced that the estimated 4 to 5 billion dollars a year now being invested in space research and space flight by all the nations of the world could well provide more immediate solutions to our general social problems, if spent directly for such purposes. It is, furthermore, a fundamental truth that the present rate of investment in space research stems completely from the ideological conflict that presently exists throughout the world.

If one looks at the situation in a long-range and perhaps more penetrating way, it should be recognized that only a small fraction of one per cent of the gross world product is presently being invested in space research. For this investment, at least some reasonably immediate practical returns seem assured. These are advanced knowledge of meteorology and consequently a likelihood of greatly improved long-range weather forecasting, the achievement of more direct communication between all points of our globe, and an advanced capability in the fields of materials and energy conversion. If we can rely upon the lessons of history, these specific accomplishments that should result from space research will undoubtedly benefit society in numerous ways. Beyond these accomplishments we must again rely upon the past lessons of history, and anticipate that continued exploration of the unknown cosmos will reveal significant but as yet unpredictable results which can benefit us all. The aura of uncertainty, tempered by the hope for new and useful knowledge, represents a motivation to man that has always been an essential ingredient in advancing civilization. Space research adds a new and larger dimension to this pattern of the past.

Trends in Mineral Research

In the face of diminishing high-grade deposits, mineral processing research is intensifying its application of scientific principles and cooperation with other disciplines to meet coming demands for metals and minerals.

by ROBERT J. BRISON

The electron probe microanalyzer, which is capable of analyzing mineral inclusions as small as a few microns in diameter, is typical of new scientific tools available for mineral research.

OBTAINING ADEQUATE SUPPLIES of minerals is likely to be one of the top problems facing many nations in the future. Rising living standards and expanding populations mean an ever-increasing demand for more buildings, transportation and communication facilities, home appliances, fertilizers, and the many other modern necessities that are derived largely from minerals.

Most of the mineral raw materials needed by man occur in nature only in dilute or impure form, and hence require considerable processing before they can be used. The rising demand for minerals is rapidly exhausting the more concentrated deposits, particularly in the more industrialized nations. Although the quantity of such minerals in the earth's crust is enormous, their recovery from less and less favorable deposits will present a continuing challenge to mankind. Moreover, technology's advance often calls for minerals, such as uranium or niobium, which although abundant, are found only in highly diluted form.

As a result of these conditions, copper, for example, must now be extracted from ores containing less than 1 per cent of the metal and uranium from ores with less than 0.1 per cent. In the case of gold, 5 tons of rock must be processed to obtain one ounce of the metal.

Today, many countries are meeting the demand for minerals by importing what they need from other countries which still have large, high-grade deposits. This is being done increasingly. Indeed, a recent study led to predictions that by 1980 the United States will have adequate domestic production of only 6 of 23 major mineral raw materials—coal, cement, gypsum, phosphate, potash, and molybdenum. It was also predicted that imports of most of the other materials would have to be substantially increased if the nation is to maintain adequate supplies of all minerals.

Undoubtedly, for some time, various materials will still be available in other parts of the world. Yet, as

supplies dwindle, nations will become more reluctant to export what they have. Already we see evidences of this reluctance; and supply difficulties are likely to increase as nations seek to protect their deposits of irreplaceable natural resources or to process their mineral resources into high-value materials for exports. The nations or groups of nations that can produce most of their own mineral raw materials will have a definite advantage in industrial and economic competition in the future.

Nations of the communist bloc recognize the great importance of minerals and mineral research. Following the 1960 convention of the American Institute of Mining, Metallurgical, and Petroleum Engineers, the *Mining Journal* (of London) stated that "Not the least noteworthy aspect of the . . . convention . . . was the attention accorded the rapid progress of mineral and metallurgical development in both Russia and Communist China". Commenting on the Fifth International Mineral Processing Conference held in London (April, 1960), the *Mining World* recorded the "shocking but unchallengeable statement" that "Russia is now the world center of ore flotation research".

There are several aspects in which research is important to the over-all problem of mineral-resource development. These include geological, geophysical, and geochemical exploration, mining, mineral processing, utilization of products, and substitution of abundant materials for scarcer materials. In addition, research may open up vast new reserves of raw materials from the ocean and the ocean floor. In this article, however, attention will be directed to the field of mineral processing, i.e., the processing of crude mineral mixtures derived from the earth's crust to obtain primary products useful for manufacture or direct consumption.

Obviously, the advancement of United States technology in mineral processing is of critical importance. The improvement of existing processes and the discovery of new ones can mean the difference between abundance and scarcity of basic raw materials in the years ahead. Modern trends in mineral research—the scientific approach to mineral problems, the closer relation with other technologies, and the application of automation—can provide the means for achieving the kind of progress that is needed.

Scientific Approach to Mineral Research

One of the significant trends in mineral research is the gradual abandonment of the time-honored concept of mineral processing as an art and its growing recognition as an applied science. Research based on a broadening foundation of scientific knowledge is replacing empirical experiments. The traditional procedure for determining the best method for processing ores has been to subject them to methods most successfully used with similar ores in the past. This approach often provides a satisfactory, economical answer; often it does not, and it seldom leads to basic improvements in technology. The modern approach is to analyze all aspects of a problem—scientific and economic—and then determine how science can be applied to yield the best solution.

In the separation of minerals and metals, research is no longer limited to traditional separation processes based on only a few well-known properties or reactions. Researchers are more frequently seeking answers to questions such as these: In what physical or chemical properties or reactions do the materials to be separated differ? How can these differences be used, directly or indirectly, to effect an economical separation?

This type of approach has already resulted in basically new commercial processes.

The International Salt Company, for example, is using a new method, for removing impurities from rock salt. In this process, the crude salt is first exposed to radiant heat. The impurities absorb the radiant heat and become warm, while the rock salt transmits the radiant heat and remains cool. The warm, impure particles adhere slightly to a belt covered with a heat-sensitive resin, while salt remains free. Separation takes place at the end of the belt. The cool salt is thrown into one container; the adhering impurities drop directly into another. This Battelle idea, using various differential heating techniques, may solve other separation problems.

Some uranium ores are now being concentrated by utilizing the radioactivity of the ore to control the

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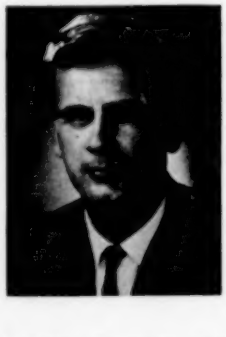


Robert Brison's research in mineral processing has ranged from development of froth-flotation procedures for concentration of columbium, germanium, and other metals and minerals to study of new methods for solid-solid separations. He played the key role in the development of the thermoadhesive separation process now used for upgrading rock salt, and he and his colleagues have been exploring its applicability to other separation problems. Brison's other interests have spanned such diverse areas as evaluation of chemicals as flotation reagents, reclamation of industrial diamonds, applications of the solid-liquid cyclone in mineral processing, and development of high-capacity electronic sorting methods for bulk materials.

separation of the uranium-bearing ore from the barren rock. Sorting devices, based on still other properties of the minerals and employing modern electronic equipment, are being developed. This sorting type of process, in which a signal from individual particles controls the separation, appears destined for a major role in the separation of coarse and granular-size materials of many types.

Sherritt Gordon Mines is recovering nickel, copper, and cobalt by a process based on a discovery by Canadian Professor Frank Forward. The ore is first concentrated by froth flotation; then the metals are leached from the ore in a solution of ammonia in autoclaves (large pressure cookers); and finally the metals are separated from the leach solution.

Separation and purification processes involving metals in the gaseous state are attracting attention. Improved processes of this type are being sought through the study of basic data, such as those relating vapor pressures and temperatures of metals or of their volatile compounds (e.g. chlorides, iodides, and carbonyls) and the study of reactions involved in the formation of such compounds.

Chlorination or volatilization of metals as chlorides is already being used in the extraction of titanium and zirconium. It offers interesting possibilities, also, for processing ores of tin, oxide lead, beryllium, niobium and manganese. Ultrapure chromium metal is being made by deposition from chromium-iodide vapor by a process developed at Battelle.

The scientific approach is leading, too, to improvement of well-established processes. In the widely used froth-flotation process, in which countless tiny bubbles lift millions of tons of valuable minerals out of finely ground ore pulps each year, the pace is quickening in the scientific search to learn exactly what happens, on an atomic scale, at the all-important interfaces between mineral particles and water. Radioactive isotopes are being used in this work to tag and study the compounds involved in the surface reactions. This research on the mechanism of surface reactions holds out the promise of revolutionary improvements in application of the flotation process. As implied earlier, Russian investigators are now engaged in extensive state-supported research on flotation fundamentals, far surpassing all other countries, including the United States, in the number of scientific papers on the subject.

Radioisotopes are also being utilized in the study of hydrometallurgical and pyrometallurgical processes. For example, in work by the U.S. Bureau of Mines on processing of beryllium ore concentrate, the use of a radioactive beryllium tracer made it possible to obtain complete results from each experiment within 4 hours,

Nuclear energy in various forms is useful in mineral-processing research. The use of radioisotopes as a possible means for controlling a process is shown above. Other potential uses range from the study of reactions at mineral surfaces with tagged chemical compounds to the mining and processing of low-grade ore deposits by means of nuclear devices.

where 2 or 3 days would have been required by conventional techniques.

Irradiation is being used in a series of experiments by Battelle on the wear of balls used for grinding ore. As many as 12 types of balls are evaluated simultaneously by tagging them with radioactivity at different levels. The balls can then be recovered easily from large grinding mills and identified by type according to level of radioactivity. The relative wear rates can then be easily determined.

In this important area of the grinding of minerals, other science-based research is aimed at finding basically new and better principles. Comminution, which includes both crushing and grinding, is the most costly step in the processing of most ores. The efficiency of comminution is estimated to be only a few per cent of what is theoretically possible. Recognition of the great potential of a basically more efficient method is spurring research. A fascinating new tool for comminution is an electrohydraulic device, pioneered in Russia, in which ore is broken by high-voltage electrical discharges under water. Other new comminution

methods are also being investigated. But none so far shows definite promise for greatly improved efficiency; the challenge remains as big as ever.

The applicability of science to magnetic and electrostatic separation processes is obvious. Equipment is being developed to magnetically separate minerals that a few decades ago were considered to be nonmagnetic for all practical purposes. Electrostatic separation of minerals is becoming a better-defined science and a more versatile industrial separation tool.

Even in the ancient "art" of gravity concentration, based on differences in specific gravity, new and better ways are being found. Long a tantalizing possibility, the use of centrifugal force in gravity processes is now an industrial reality. Particles of iron ore as small as 0.01 inch in diameter are separated by mixing with a finely ground slurry of magnetite and water and whirling the mixture in cyclones so that the iron-ore concentrate is ejected at one end and the waste rock at the other.

The ideal gravity separation process would be one in which the separation is actually made in a heavy liquid of specific gravity intermediate between that of the valuable mineral and that of the waste material. Although this technique has been used as a laboratory tool for decades, the high cost of the heavy organic liquids involved has prevented successful commercial utilization of such a process. Recent developments in the production of tetrabromoethane (specific gravity 2.95) and in methods for its recovery from the separated minerals now opens up the possibility of large-scale use of this type of process.

In practical laboratory experimentation in mineral processing, a more scientific methodology is gradually replacing the cook-book, trial-and-error approach. For example, the last decade has seen the beginning of attempts to apply the principles of statistical design and analysis to flotation studies. Statistical procedures offer promise for more effective planning of experimental work in minerals research as well as more objective analysis of the significance of results.

Mineral Research and Other Technologies

A few decades ago, mineral processing was considered as almost an isolated art, largely unaffected by, and unconcerned with, other areas of technology. Today, the artificial barriers between technologies are crumbling. Mineral processing has already benefited greatly by borrowing from other fields, but stands to gain much more. With the rapidly expanding scope of science and technology, it is becoming increasingly probable that any new basic information or tool needed in mineral research may be available or readily obtainable in some other, perhaps seemingly unrelated, field. Conversely, advances in other fields are often dependent on the products of mineral processing research. From a broader standpoint, the dependence of mineral research on other fields is but one example of the increasing interdependence of all branches of science and engineering.

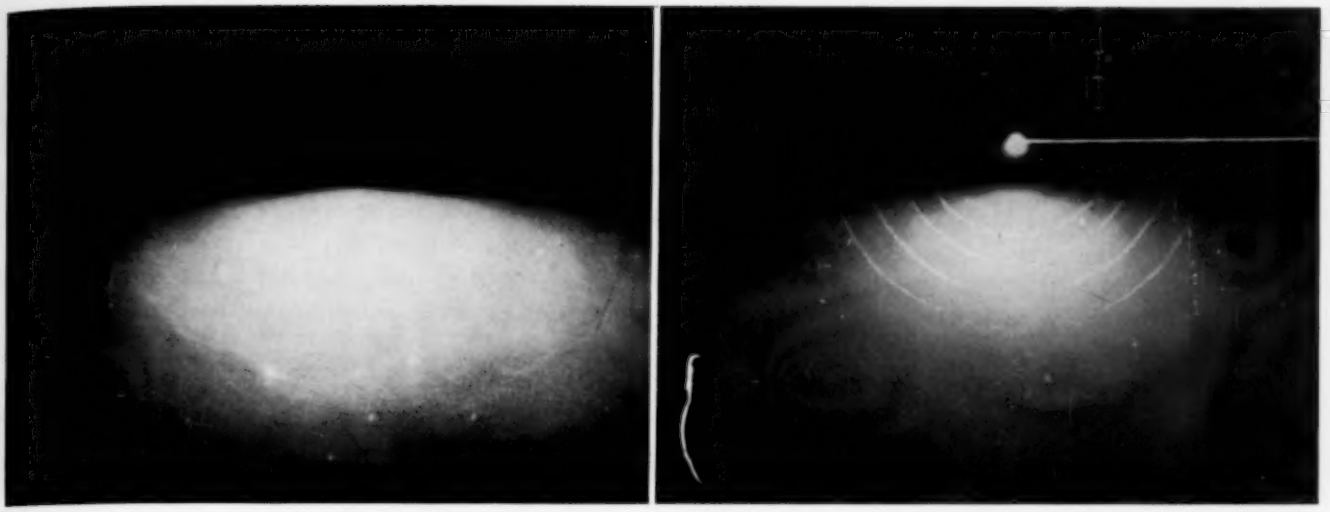
Chemistry and chemical engineering have played a large part in advancing minerals processing. They have made possible the successful application of solvent extraction and ion exchange to the processing of uranium ores, the solvent-extraction separation of hafnium from zirconium, and they have contributed to research on the chemical extraction of copper, nickel, cobalt, zinc, and manganese.

The fluidized-bed reactor, perhaps the most significant innovation in pyrometallurgy in the last 20 years, was initially developed by the petroleum industry for catalytic cracking. In this technique, a bed of solid particles is maintained in a state of agitation, resembling that of boiling water, by an upward flow of gas. Commercial applications in the minerals and metals field already range from the processing of titanium to the direct reduction of iron ore. Fluidized-bed processes, with their advantages of excellent solid-gas contact and uniform control of temperature and gas composition, offer particular promise for high-temperature solid-gas reactions.

Nuclear technology provides a powerful tool for research in many phases of mineral processing. It has contributed to a device for prospecting for beryllium ore. It is being applied in studies where the separation of minerals is accomplished through the use of induced radioactivity. Radioactivity also serves as a basis for devices useful in the automatic control of processing plants.

The plasma, or ionized-gas state of matter such as exists in most stars, including our sun, was orginally of interest mainly to astrophysicists. During the last decade, this fourth state of matter has received increasing attention wherever ultrahigh temperatures are important. Today, plasma devices are being enthusiastically explored for high-temperature reactions in extractive metallurgy.

If one were asked a decade ago what science or technology was least likely to contribute to the progress of mineral processing, microbiology might well have been an answer. In recent years, however, biologists and mineral engineers have been working together in research on ways to use bacteria to extract copper and other metals from low-grade ores. Who can say what science or technology will not be important to mineral processing research of the future?



Electron diffraction patterns of a beryl mineral surface before and after treatment with 1, 6-hexanediamine. The patterns, created when electrons are diffracted from materials, reveal the nature of the crystal structure of the beryl (left), and give evidence of the adherence of the chemical (right). The data give the scientist a clue as to the effect of the chemical treatment on the flotation properties of the mineral.

Automation

In this age of automation, mineral processing plants will be no exception to the trend toward the ultimate goal of completely automatic control. This industry has long been highly mechanized; in a modern plant, thousands of tons of ore per day are processed from mine to smelter without being handled by human hands, and with only a few operators in attendance.

A recently completed 6000-ton-per-day mill processing nickel-copper ore in the Sudbury area of Canada makes extensive use of centralized control and recording equipment. Of special interest is its use of automatic regulation of pulp density by a nuclear radiation device.

But automatic control in the industry is in its infancy. The problems involved have been formidable—such as automatically analyzing for several elements a slurry of solids suspended in water or delivering a suitable sample to the analyzer. The large number of production units requiring individual control also adds to the complexity. Major advances are being made toward solving these problems. In this area, too, much of the needed know-how is becoming available from other fields.

Particularly significant is the rapid progress in development of automatic equipment for on-line analysis of slurries and solids by the X-ray-fluorescence spectroscopy method. Such a unit has been installed at the Anaconda copper concentrator in Montana. As a step toward the rapid analyses required for the constant control of automatic processes, equipment that will analyze samples for six elements and record the results within 2 minutes is now available. Conventional methods, on the other hand, could provide the same data only after an extended period (often 8 hours or more); and meanwhile a considerable tonnage of ore would have passed through the process before the information would be available.

Analysis of products is, of course, only one of many essential control factors in a mineral processing operation, and many kinds of measurement and control equipment will be needed. Already, devices such as gamma-ray absorption meters for level and density control and electromagnetic flowmeters appear destined to become commonplace in the mineral processing plants of tomorrow along with the already well-established control devices.

Much of the instrumentation for automation of mineral processing will be "imported" from other fields of technology. But a large part of the new knowledge will have to come from research in the mineral industry itself. This research will include:

1. Application and adaptation of available control equipment to mineral processing
2. Development of special equipment and techniques as needed, for example, development of means to deliver samples to automatic analyzers
3. Basic research to improve understanding of mineral-processing operations and thereby lay a firm basis for establishing the principles of control
4. Modification of existing processes to make them more amenable to automation

5. Development of new processes better suited to automation than existing processes
6. Study and design of the over-all operation and control of the mineral processing plant as a unified system.

Implications of New Trends

These trends toward science-oriented research, toward close relationship with other technologies, and toward automation, have important implications not only for the mineral industry but also for the world as a whole and the United States in particular.

The day has passed when most of the specialized knowledge needed by a mineral research engineer can be crammed into a few textbooks, when a laboratory equipped only with conventional mineral-processing laboratory tools can be considered complete. The mineral engineer of today still needs to be familiar with conventional processes, but, more importantly, he needs more than ever before an understanding of the basic sciences involved and an awareness of developments in the ever-widening spectrum of related technologies. The applied-mineral-processing laboratory of today still needs the facilities for studying conventional processes; but if it is to play a part in the revolution now under way, it needs even more the wide scope of personnel and facilities for a science-based approach and for ready access to the scientific knowledge and techniques of other branches of technology.

For the United States and its mineral industry, the modern research approach, if adequately encouraged and supported, can help to ensure ample future mineral supplies and perhaps even reverse the trend toward ever-increasing imports.

For all mankind, it can help to provide mineral raw materials of the future in abundance, in spite of the continuous depletion of higher-grade deposits and the booming world population.

SCIENCE'S RETURN FROM TECHNOLOGY

"Pure science receives a great return from what it contributes to technology, and this in two ways, materially and in the realm of ideas. Consider first the material return: a modern physics laboratory could not work without instruments developed for technology and obtainable cheaply because industry needs them in large numbers . . .

"The other influence of technology is more subtle but as important. As science advances, concepts tend to become more and more abstract . . . Is there not a danger that one may lose touch with reality and end up by supposing that some elaborate piece of mathematics represents reality when it is only a creation of the mind, inspired by physical reality, but no more like it than is a modern picture? . . . But when conclusions deduced from precise experiments by mathematical theory lead to detailed predictions from which working machines can be designed, machines which without the theory no one would have thought of in a million years, then indeed one knows that one lives in a universe which is rational and that one has found the key to one of its rooms."

Sir George Thomson, Master of Corpus Christi College, Cambridge, England, in *Science*.

Writings by STAFF Members

Neutron-Flux Measurements in a Concentric-Cylinder Fuel Element. Measurements were made in a gas-cooled in-pile loop operated adjacent to the core of the Battelle Research Reactor. Radial, vertical, and peripheral flux distributions were studied. The vertical flux profile was cosine-shaped with a peak-to-average ratio of 1.26. The peripheral variation around the loop wall could also be fitted to a cosine curve (with a peak-to-average ratio of 1.10). The average radial flux depression from the outer fuel-cylinder to the center of the element was a factor of 2.14. Power generation in the element calculated from flux measurements agreed to within 10% with the power generated by measuring gas flow rate and temperature rise across the fuel element. The ratio of peak-to-average power density was found to be 1.75. ***James N. Anno, Barry P. Fairand, and Joel W. Chastain, Jr.*** U. S. Atomic Energy Commission, *BMI-1314*, Jan. 29, 1959, 24 pp. (LC mi $4.80)

Hydrolysis of Univalent Salts in Aqueous Solutions. The Hydrolysis of Weak Acid-Weak Base Strong-Electrolyte Salts. For the case of weak acid-weak base strong salts, where the ionization constants of the acid and base involved differ appreciably, the hydrolysis constant, usually derived from simple Arrhenius' theory, gives an inadequate and contradictory description of the solutes in dilute solution. The rule that electrolyte solutions are electrically neutral can be derived from the Law of Conservation of Matter, and can be applied to simple arithmetic recursive correction of the usual description to produce corrections of a desired order of accuracy. ***Jack J. Bulloff.*** *Ohio Journal of Science*, v. 61, no. 1, Jan. 1961, pp. 60-64.

Uranium Dioxide-Stainless Steel Specimens for Irradiation in Sodium—Experiment PW-5-1. Describes preparation, preirradiation testing, and encapsulation of cored, plate-type fuel elements for irradiation in stagnant sodium. ***G. D. Calkins, M. Pobereskin, J. R. Keeler, and D. L. Keller.*** U.S. Atomic Energy Commission, *BMI-X-127*, April, 1955, 19 pp. (LC mi $2.40, ph $3.30)

Structural Materials for Thermal Nuclear Reactors Operating at About 1950 F With Air as a Coolant. Surveys potential of various metals and alloys for use as cladding materials in a nuclear reactor operating in air at 1950 F. Certain austenitic stainless steels and some nickel-base alloys appear to have properties which meet the design criteria. ***W. Chubb, J. A. DeMastry, S. G. Epstein, R. W. Endelbrock, D. P. Moak, and R. F. Dickerson.*** U.S. Atomic Energy Commission, *BMI-X-159*, July 1960, 76 pp. (LC mi $4.80, ph $13.80)

Progress Relating to Civilian Applications During July, 1959 and October, 1960. Gives recent progress in work being done at Battelle on development of nuclear elements, processing of feed materials, design of components, and characterization and evaluation of nuclear metals and other materials. ***Russell W. Dayton and Clyde R. Tipton, Jr.*** U.S. Atomic Energy Commission, *BMI-1366* and *BMI-1473*, Aug. 1, 1959 and Nov. 1, 1960, Sections individually paged. (LC mi $5.70, ph. $16.80 and OTS $2.00)

Further Studies With the GCRE Critical Assembly. Describes studies of the effect on reactivity caused by changes in axial reflector materials, the effect on reactivity and power perturbation caused by fast safety-control-blade guides, and effects of changes in fuel-element material composition and spacing. ***David A. Dingee, William C. Ballowe, Richard A. Egen, F. J. Jankowski, and Joel W. Chastain, Jr.*** U.S. Atomic Energy Commission, *BMI-1306*, Dec. 29, 1958, 36 pp. (LC mi $3.00, ph $6.30)

A Study of the Spectral Emissivities and Melting Temperatures of Osmium and Ruthenium. Gives expressions for the variation of spectral emissivity with temperature. The melting temperatures of osmium and ruthenium were determined as 3010 ± 10 and 2250 ± 10 C, respectively. ***R. W. Douglass and E. F. Adkins.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers,Transactions, Metallurgical Society*, v. 221, no. 2, April, 1961, pp. 248-249.

Refining of MgX and Other Uranium-Bearing Materials. Quarterly Progress Report. Results are presented of Scheibel column extraction tests with neutral ether on a variety of combinations of feed solutions. Feed materials tested included pitchblende, MgX, and V-20 soda salt. The effect of added iron was evaluated for a considerable number of process solutions and slurries. Arsenic was traced through both primary and secondary stages in one test. ***R. A. Ewing, S. J. Kiehl, Jr., R. E. Sharpe, and A. E. Bearse.*** U.S. Atomic Energy Commission, *BMI-254*, June 30, 1951, 52 pp. (LC mi $3.60, ph $9.30)

The Corrosion of HyMu 80 Fluorinators. Short-duration tests showed HyMu 80 to be more resistant than Ni, which showed considerably greater tendency for intergranular attack. The corrosion of Ni appears to be accelerated by UF_4 in the melt. Grain growth occurred in some fluorinators. ***F. W. Fink.*** U.S. Atomic Energy Commission, *TID-5935*, May, 1960, 28 pp. (LC mi $3.00, ph $6.30)

An Analog Approach to Reliable Transistor Circuits. Describes design, construction, and operating characteristics of a transistor thermal analog for determining the junction temperature-rise produced by various forms of power input. ***H. T. Gruber.*** Paper from *Proceedings of Seventh National Symposium on Reliability and Quality Control*, Institute of Radio Engineers, Inc., New York. 1961, pp. 474-484.

Effects of Irradiation on the Mechanical Properties of Tantalum. Sheet tensile specimens were irradiated in the MTR in an attempt to produce conversions of tantalum to tungsten of approximately 1.5 and 3.0 w/o. The tensile and yield strengths of tantalum were found to increase appreciably as a result of irradiation, whereas the tensile properties of unirradiated tantalum-tungsten alloys prepared by arc melting showed that small additions of tungsten do not significantly increase the strength of tantalum. ***Charles K. Franklin, David Stahl, Frederic R. Shober, and Ronald F. Dickerson.*** U.S. Atomic Energy Commission, *BMI-1476*, Nov. 18, 1960, 19 pp. (OTS $0.50)

Preparation and Properties of Grown P-N Junctions of InSb. Grown p-n junctions of InSb were produced by doping high-purity n-type melts with zinc. The crystals were oriented so that the growth axes of the crystals were perpendicular to a (111) plane. The effects of anisotropic distribution of impurities within the crystals were observed in the electrical properties of the diodes. The lifetime of minority carriers at high

HOW TO GET COPIES OF STAFF WRITINGS

In this section are listed reports, articles, and other writings authored by Battelle staff members that have recently become generally available. • *Reports, unless otherwise indicated, can be purchased prepaid directly from the Office of Technical Services, U.S. Department of Commerce (designated OTS), Washington 25, D. C. or from the Publication Board, Library of Congress (designated LC), Washington 25, D. C. The PB number or, in the case of the U.S. Atomic Energy Commission Reports, the AEC number of the report must be listed with the order.* • *Federal agencies and government contractors, their subcontractors, and suppliers may obtain DMIC Reports gratis from the Defense Metals Information Center, 505 King Avenue, Columbus 1, Ohio.* • *In most cases, copies of articles and papers listed in this section—but not in the Abstracts Section which follows—are available gratis from the Battelle Publications Office, 505 King Avenue, Columbus 1, Ohio.*

injection levels (forward bias) was observed. Anomalous values are attributed to changes in properties of the bulk material rather than the surface. The curves of current density as a function of temperature showed leakage currents to predominate at lower temperatures and saturation currents to predominate at higher temperatures. This observation was verified by current-voltage profiles at appropriate temperatures. ***H. C. Gorton, A. R. Zacaroli, F. J. Reid, and C. S. Peet.*** *Electrochemical Society, Journal,* v. 108, April, 1961, pp. 354-356.

Variational Characterization of a Sum of Consecutive Eigenvalues: Generalizations of the Inequalities of Pólya-Schiffer and of Weyl. A very simple extremal property of a sum of consecutive eigenvalues, suggested by a paper of Pólya and Schiffer, is established; it is a generalization of Rayleigh's principle for the first eigenvalue. This tool is then used to obtain inequalities containing as special cases inequalities of Pólya-Schiffer (1953) and inequalities of Weyl (1912). (*In French.*) Caractérisation variationnelle d'une somme de valeurs propres consécutives; généralisation d'inégalités de Pólya-Schiffer et de Weyl. ***Joseph Hersch.*** *Comptes Rendus des Seances de l'Academie des Sciences,* no. 252, March 20, 1961, pp. 1714-1716.

Corrosion in Cryogenic Liquids. Cryogenic propellants can be handled by stainless steels. For missile service, titanium has more desirable strength-weight properties. However, titanium occasionally has shown impact sensitivity to liquid oxygen and fluorine. This paper discusses corrosion mechanisms and the physical behavior of titanium and other metals in cryogenic propellants. ***James D. Jackson.*** *Chemical Engineering Progress,* v. 57, April, 1961, pp. 61-64.

Evaluation of Reactor Core Materials for a Gas-Cooled Reactor Experiment. Describes work on high-hydrogen delta-phase zirconium hydride moderator materials clad by a pressure-bonding technique, control materials composed of rare-earth-oxide dispersions in Nichrome V or cobalt alloys, fuels, and reaction of metals with nitrogen or ammonia coolants. ***D. L. Keller.*** U.S. Atomic Energy Commission, *BMI-1208,* July 1957, 94 pp. (LC mi $5.40, ph $15.30)

New Prime Movers for Gas Air Conditioning. Compares characteristics of opposed-piston, Wankel, and Stirling-Cycle engines, gas and steam turbines, and the free-piston gas-engine compressor. ***R. J. McCrory.*** *American Gas Association Research and Utilization Conference* April, 19-21, 1960, Cleveland, Ohio, Catalog no. 131/DR-10, 7 pp.

Neutron-Flux Measurements in a Flat Plate Fuel Element. Describes equipment and experiments to measure the thermal-neutron-flux distribution in a fuel assembly of an experimental loop mock-up of a gas-cooled reactor at the Battelle Research Reactor. The measurements showed that an average thermal-neutron flux of 4.09 x 10^{13} neutrons/(cm^2)(sec) or a power generation of 45 kw in the assembly can be conveniently obtained. The ratio of the peak thermal-neutron flux to average thermal flux in the entire element was found to be 1.87. ***Walter R. Morgan, James N. Anno, Jr., and Joel W. Chastain, Jr.*** U.S. Atomic Energy Commission, *BMI-1231,* Oct. 31, 1957, 52 pp. (LC mi $3.30, ph $7.80)

Production and Availability of Some High-Purity Metals. The preparation of metals of the highest purity requires the combined use of a number of specialized techniques. Among the more important processing steps, purification of halide compounds of metals and their decomposition or reduction under carefully controlled conditions, vacuum melting by arcs or electron bombardment for consolidation, and final purification by zone refining are potentially of the greatest utility. Electron-bombardment melting and zone-refining equipment are the only types of general utility in the preparation of high-purity metals. ***E. M. Sherwood and V. S. Secrest.*** PB 161226; Battelle Memorial Institute, Defense Metals Information Center, *DMIC Memorandum* 76, December 2, 1960, 48 pp. (OTS $0.50)

Notched Longitudinal-Bend Specimens for Evaluating Armor Weldments. A longitudinal-bend specimen was used to evaluate the toughness performance of high-strength armor-steel weldments prepared with austenitic and ferritic Grades 180 and 230 coated electrodes. The data from the bend specimens were compared with test results of H-plates made with the same lot of base plate and with similar electrodes. This work demonstrated that the modified longitudinal-bend specimen may be used as a partial substitute for the more costly H-plate test for evaluating the toughness performance of weldments in high-strength armor steel. ***S. M. Silverstein, R. P. Sopher, and R. J. Rieppel.*** *Welding Journal,* v. 40, March, 1961, p. 113s-117s.

Manual for Beryllium Prospectors. Describes likely geological environments for beryllium minerals, ways of estimating beryllium content of ore samples in the field, data on economic and technical aspects of beryllium production, and mineralogical characteristics of beryllium minerals. ***W. L. Smith.*** PB 151105; Battelle Memorial Institute, Defense Metals Information Center, *DMIC Report No. 146,* January 18, 1961, 35 pp. (OTS $1.00)

Measurements Pertaining to Hydrogen Embrittlement. Measuring techniques which have been useful in hydrogen-embrittlement studies are described, and their usefulness for future studies is critically examined. Included in the discussion are hydrogen-charging methods, stressing methods, analytical problems, surface effects, and related phenomena. Problems in developing a standard embrittlement test are outlined. ***Cloyd A. Snavely.*** Paper from *Technical Proceedings of the Forty-Seventh Annual Convention, American Electroplaters' Society, July 24-28, 1960.* pp. 138-142, 1960. American Electroplaters' Society, Inc., Newark, New Jersey.

Safflower Oil Adducts as Plasticizers. Eleven esters and epoxides of adducts of conjugated linoleic acid with maleic and acrylic acids, and esters and epoxides of adducts of vegetable oils with acrylic and maleic esters were evaluated as plasticizers for polyvinyl chloride (PVC), acrylonitrile rubber, and polyvinylidene chloride, and in PVC plastisols. The dimethyl ester of the acrylic adduct of linoleic acid and its epoxide were the most promising as plasticizers for PVC and in PVC plastisols as their performance compared favorably with that of controls. In polyvinylidene chloride, however, these adducts had a slight adverse effect on color stability. The vegetable oil adduct esters and epoxides were incompatible with PVC but had extremely good compatibility with acrylonitrile rubber. In general, they performed like the petroleum type of plasticizers but were less volatile and less easily extractable. ***H. M. Teeter, J. C. Cowan, L. E. Gast, W. J. Yurgen, and R. A. Clark.*** *American Oil Chemists' Society, Journal,* v. 38, March, 1961, pp. 117-120.

Rocket-Nozzle Testing and Evaluation. Deals with the testing and evaluation of nozzles for solid-propellant rocket engines. Reproducibility of test results is discussed first. Then, the general problem of simulation of nozzle exposure conditions is covered. Finally, as an example of a simulation study, the results of a study of small-scale nozzle simulation are presented. ***E. W. Ungar.*** PB 161227; Battelle Memorial Institute, Defense Metals Information Center, *DMIC Memorandum* 77, December 7, 1960, 17 pp. (OTS $0.50)

Analysis of the Amount of Preferred Orientation by X-Ray-Diffraction Line Intensities. The X-ray diffraction intensity formulas published by James and by Compton and Allison were derived for specific experimental conditions which are not employed in the parafocusing diffractometer. Although these equations are satisfactory for relative intensity data, they fail to agree with the experimental data where absolute intensities are required. The formulas presented here introduce the effect of divergent beam geometry which is employed in most diffractometers. Although the evaluation of the effect of this divergence is not precise, the agreement between observed and calculated values is improved considerably over that obtained using previous formulas. ***D. A. Vaughan.*** U.S. Atomic Energy Commission, *BMI-X-156,* June, 1960, 11 pp. (LC mi $2.40, ph $3.30)

Recent Developments in Superalloys. Highlights some of the newer superalloys—nickel base and cobalt base—and discusses some of their important properties and characteristics. ***H. J. Wagner.*** PB 161214; Battelle Memorial Institute, Defense Metals Information Center, *DMIC Memorandum 64,* Sept. 8, 1960, 16 pp. (OTS $0.50)

NOTES from BATTELLE

* OXIDATION OF TANTALUM ALLOYS

The demand for materials capable of operating at temperatures of 1100 C (2000 F) and above, under oxidizing conditions, has stimulated interest in refractory metals and their alloys. Tantalum is a promising candidate because of its high melting point and excellent low-temperature ductility. Though the metal oxidizes rapidly above 800 C, research has shown that alloying can improve its oxidation resistance.

In reporting on recent research for Wright Air Development Division's Materials Central, William D. Klopp, Daniel J. Maykuth, and H. Russell Ogden describe how tantalum-titanium alloys are improved by ternary and quaternary additions of aluminum, beryllium, chromium, and silicon. The Battelle metallurgists point out that additions of 1 to 10 per cent of the four elements to a tantalum alloy, containing 20 to 40 per cent titanium, improve oxidation resistance about ten-fold. The alloys with greatest oxidation resistance are Ta - 30Ti - 9Cr, Ta - 30Ti - 5Al - 1.5Si, and Ta - 40Ti - 10Al. At 1200 C, they oxidize only about four times faster than 80Ni - 20Cr. At the same time, the contamination resistance of the alloys is about double that of unalloyed tantalum.

The effect of the four alloying metals on the oxidation of tantalum-titanium are related to the thermodynamic and physical stabilities and electrical resistivity of their oxides. Aluminum, the most effective addition, forms an oxide (Al_2O_3) which is a thermodynamically stable refractory and has a low oxide/metal volume ratio and high electrical resistivity. Aluminum was most effective in improving contamination resistance, and the Ta - 40Ti - 10Al alloy exhibited the best oxidation and contamination resistance of the alloys studied.

* PLATING CHROMIUM ON ALUMINUM

When chromium is electroplated on aluminum by present methods, the plated metal tends to crack and peel if an undercoating (such as zincate dip, cyanide copper, or nickel) has not been applied first. A new technique, however, provides an attractive chromium plate which adheres well to the aluminum. The method was developed recently at Battelle for the General Development Corporation.

Chromium plate has been shown to result from the electrodeposition of unstable chromium hydride. Some time after being electrodeposited the material decomposes into hydrogen gas and chromium, the latter contracting as a result of stress. It is this contraction which gives chromium its well-known crack pattern and causes it to exfoliate away from a weaker basis metal. Aluminum is such a metal, and chromium plated directly on it tends to form nonadherent flakes.

According to Charles L. Faust, Glenn R. Schaer, and Donald E. Semones, chromium can be plated effectively if chromium hydride is deposited and then allowed to decompose before another deposition step. As developed at Battelle, the process comprises alternate "on time" (deposition) and "off time" (no deposition) steps. A crack-free chromium plate is built up because each layer is allowed to stabilize before the succeeding layer of chromium hydride is deposited.

The resulting plate has exceptionally good adherence to the aluminum, and it is smooth and semibright. Light buffing brings the chromium to full brilliance. Corrosion performance is unexpectedly good with plate thicknesses of 0.15 to 0.3 mil. When duplex nickel 0.2 to 0.8 mil thick is applied over this chromium and a final 0.025 to 0.050-mil-thick chromium plate applied, corrosion performance and appearance are exceptional.

* IMPROVING ELECTRICAL ALLOYS

Tailor-making alloys for specific tasks long ago became an accepted procedure for metallurgists. Specially designed alloys are needed particularly for creation of electronic components to meet specific demands.

Many of the electrical alloys in use today were developed years ago by rather crude "cut and try" methods and still reflect the limited data on electrical properties available then. Present-day requirements for electronic alloys are becoming more difficult to satisfy with such materials. The newer theoretical concepts of the structure of metals, are being used increasingly to orient and direct studies aimed at developing alloys with particular combinations of electrical and other properties.

Battelle metallurgists Curtis M. Jackson, Joseph G. Dunleavy, and A. H. Hall recently discussed the problems of improving electrical alloys in a paper presented

before the 1961 Electronic Components Conference. They pointed out that characteristics important in desirable electrical alloys include:

- Predictable and reproducible electrical resistance at any temperature at which the alloy will operate and with the smallest possible change in resistance with temperature changes.
- Reliability, with a very high probability of performing properly at any time under service conditions and with properties that remain stable during use or storage.
- Reproducibility of significant characteristics from heat to heat, lot to lot, and within each lot.
- Fabricability, or the ability to be formed into required shapes. Since the alloy must be used as bar, strip, sheet, foil, or fine wire, it is necessary that it be possible to shape the material and that it retain the desired electrical properties.

The application of new knowledge to this problem, and the achievement of the desired characteristics, the metallurgists believe, may well result in the creation of alloys with combinations of properties currently unachievable.

* MORE EFFECTIVE WESTERN SCIENCE

As a step toward strengthening accomplishment among nations associated with the North Atlantic Treaty Organization, the Science Committee of NATO has outlined policies that it believes would aid in achieving such a goal. As presented in the report, *Increasing the Effectiveness of Western Science,* the Committee recommends that all NATO nations:

- Establish organizations responsible for supporting scientific research and improving the quality of scientific education.
- Seek to lift their research expenditures to a level of about 0.2 per cent of their Gross National Product for "basic" research and 2.0 per cent for research and development.
- Increase the numbers of their scientists: by expanding the opportunities for, and quality of scientific education, both secondary and university; by encouraging women to enter scientific occupations; and by training more technicians.
- Remove obstacles to research by promoting interchange of scientists between western countries; by encouraging expansion of research by industries, perhaps through tax reduction and research funds; and by giving research organizations access to foreign currency for purchase of equipment and materials abroad.
- Establish international research and educational centers in the fields of oceanography, meteorology, ecological effects of pesticides, science of materials, and space science.
- Make international funds available to assist technically less-developed North Atlantic nations.
- Encourage existing international agencies to promote exchange and employment of scientists between nations.
- Improve facilities for exchange of information between nations and encouragement of cooperation in creating better documentation processes.

BATTELLE STAFF MEMBERS recently named to technical posts include: *Charles L. Faust*—member, Achievement Award Committee, American Electroplaters' Society, Inc.; *R. F. Dickerson*—chairman, Task Force on Uranium, Subcommittee VIII, Committee B-2, American Society for Testing Materials; *John H. Litchfield*—member, Committee on Meetings and Conferences, Society for Industrial Microbiology; *Clarence H. Lorig*—member, Committee on Constitution and By-Laws, American Society for Metals; *Richard J. Lund*—vice-chairman, Program Policy Committee, Industrial Minerals Division, Society of Mining Engineers, American Institute of Mining, Metallurgical, and Petroleum Engineers; *William T. Reid*—first vice-president, Technical Association of the Graphic Arts; *William H. Safranek*—member, Publications Committee, American Electroplaters' Society; *B. D. Thomas*—member, Board of Distinguished Consultants for Ohio, Ohio Society of Professional Engineers.

HERBERT S. KIRSCHBAUM is coauthor with John D. Cowan, Jr., associate professor of electrical engineering, Ohio State University, of *Introduction to Circuit Analysis.* Working on the premise that most disciplines are "converging" on the problems of analyzing the short-time behavior of systems, the authors have emphasized that electromechanical problems will yield to rather simple fundamentals. Thus the nonspecialist will be aided in attacking engineering problems involving electricity. The new textbook has just been published by Charles E. Merrill Books, Inc.

BATTELLE
TECHNICAL
REVIEW

ABSTRACTS

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ADMINISTRATION AND PHILOSOPHY OF RESEARCH

a * **Survey of Engineering Economy Research in Educational Institutions.** Report on a survey of 155 colleges and universities made by the author in 1960. ***Robley Winfrey.*** *Journal of Engineering Education*, v. 51, no. 8, Apr. 1961, p. 661-667.

b * **Research in Our Universities.** Includes "Is Sponsored Research Destroying Our Universities" by P. R. Trumpler, "Impact of Engineering College Research on Graduate Programs and Faculty Development: Viewpoint of a Graduate Dean," by H. K. Schilling and "Viewpoint of a Research Director," by R. J. Martin. *Journal of Engineering Education*, v. 51, no. 8, Apr. 1961, p. 618-640.

c * **Memo to Management.** Presents methods to improve operational efficiency. ***Merritt A. Williamson.*** *Research/Development*, v. 12, May 1961, p. 17 + 3 pages.

d **University Research in Engineering.** Just what is acceptable research? Does the element of application—inherent in engineering as in medicine—disqualify engineering as a subject for university research? Not if we value creativity. ***George F. Wislicenus.*** *Mechanical Engineering*, v. 83, May 1961, p. 64-66.

e **Scientific and Engineering Manpower. The Immediate Problem and Suggested Solutions.** Our needs for technically trained people may shortly be expected to outrun permanently our ability to satisfy them. Possible remedial measures by government, industry, educational institutions, and the engineering profession are suggested. ***S. B. Ingram.*** *Electrical Engineering*, v. 80, May 1961, p. 341-345.

f * **Strengthening the Citadels of Research.** Stresses need for obtaining research funds for the conduct of basic research from industry to increase fundamental knowledge. ***Arthur Bronwell.*** *Research Management*, v. 4, no. 2, Summer 1961, p. 83-93.

g * **Budget and Cost Control in Research and Development.** Describes the budget cost and control system in use at the Research Center of the United States Rubber Company. ***T. L. Wilson.*** *Research Management*, v. 4, no. 2, Summer 1961, p. 95-105.

h * **Planning for Research: The Problems Involved.** Considers the key problems involved in planning for basic research, applied research, and development. ***R. W. Cairns.*** *Research Management*, v. 4, no. 2, Summer 1961, p. 107-118.

i * **Developing Managers Out of Creative Specialists.** A three-stage program for developing supervisory and management personnel involves orientation, guidance, and periodic appraisal. ***Stephen R. Michael.*** *Research Management*, v. 4, no. 2, Summer 1961, p. 119-131.

j * **Stimulating Creativity in Research and Development.** Creativity depends on imagination, intuition, and serendipity. Supervisors can further creativity by aiding the two main types of research workers—the factual and the creative—to understand the contributions that each can make. ***R. B. Mears.*** *Research Management*, v. 4, no. 2, Summer 1961, p. 147-152.

AERONAUTICAL AND ASTRONAUTICAL ENGINEERING

k * **Orbiting Astronomical Observatories.** Astronomical data from these orbiting "Mt. Palomars", which involve most precise observational and operational equipment, will open a new era in stellar studies and cosmology. ***Robert R. Ziemer.*** *Astronautics*, v. 6, May 1961, p. 36 + 4 pages.

* **Stratoscope II Telemetry and Command.** Its versatility and precision, reflecting the engineers' response to the challenge of space research, bulwark Stratoscope II's goal of mak-

* Asterisks mark items that may be used in the Battelle Library only. None of the unbound materials listed are available for interlibrary loan.

ing astronomical history from the fringe of space this year. ***Alan B. Wissinger.*** *Astronautics*, v. 6, May 1961, p. 38 + 6 pages.

* **The U. S. Planetary Exploration Program.** The goal—a comprehensive knowledge of translunar and interplanetary space by 1970—will necessitate developing new families of instruments, better thermal-control systems, and more reliable spacecraft. ***Robert J. Parks.*** *Astronautics*, v. 6, May 1961, p. 22 + 7 pages.

Experimental Evaluation of Analytical Models for the Inertias and Natural Frequencies of Fuel Sloshing in Circular Cylindrical Tanks. A correlation is presented of experimental measurement and analytical prediction of free, planar oscillations of a tank of Hg hung on a pendulum. Measured frequencies are presented for the slosh mode and the pendulum-tank mode, and time-history wave forms are included for qualitative comparisons. ***Robert W. Warner and John T. Caldwell.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-856, May 1961, 35 pp. (TL570 Un3t Room 290)

Experimental Studies of Flutter of Buckled Rectangular Panels at Mach Numbers From 1.2 to 3.0 Including Effects of Pressure Differential and of Panel Width-Length Ratio. Increasing the pressure differential was effective in eliminating flutter on most of the panels tested. An estimated flutter boundary is presented for buckled panels clamped on four edges, with width-length ratios of 0.21 to 4.0. This boundary shows that the panel width is more significant than the panel length when the ratio of width to length is less than approximately 0.5. Panels clamped on four edges and buckled in two half waves in the direction of flow were found to be particularly susceptible to flutter. ***Maurice A. Sylvester.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-833, May 1961, 37 pp. (TL570 Un3t Room 290)

Tables and Charts of the Normal Component of Induced Velocity in the Lateral Plane of a Rotor With Harmonic Azimuthwise Vorticity Distribution. The time-average induced velocities in the lateral plane of a rotor are computed for wake vorticities which vary as harmonics of the azimuth angle. The first six harmonics are treated for two wake skew angles. The calculated results are presented in the form of contour charts and tables. A brief discussion of the computing program, which featured automatic preparation of the contour charts, is also included. ***Harry H. Heyson.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-809, Apr. 1961, 200 pp. (TL570 Un3t Room 290)

Flight Investigation of Effects of Selected Operating Conditions on the Bending and Torsional Moments Encountered by a Helicopter Rotor Blade. The results indicate that the maximum moments encountered in partial-power descents with forward speed tend to be generally reduced from the maximum moments encountered during partial-power descents at zero forward speed. The results of the present investigation (tip-speed ratios up to 0.325 and an unaccelerated level-flight mean lift coefficient of about 0.6), in combination with the related results of previous investigations, indicate that partial-power vertical descents at zero forward speed produce the largest rotor-blade vibratory moments. ***LeRoy H. Ludi.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-759, Apr. 1961, 43 pp. (TL570 Un3t Room 290)

Predicted Shock Envelopes About Two Types of Vehicles at Large Angles of Attack. Methods based on oblique- and normal-shock relationships and the continuity of mass flow through suitably chosen volume elements between the shock and body were developed to predict shock envelopes about two types of vehicles being considered for atmosphere entry. One type is a high-drag capsule shape. The other type is essentially a slender triangular wing capable of providing high lift or high drag, depending on the angle of attack. Predicted and measured shock envelopes were compared for a Mach number range of 3 to 15 for vehicles at high angles of attack; good agreement was found. Most of the available experimental data were in a speed and temperature range in which no important real-gas effects occurred. ***George E. Kaattari.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-860, Apr. 1961, 34 pp. (TL570 Un3t Room 290)

A Flight Study of the Dynamic Stability of a Tilting-Rotor Convertiplane. A flight investigation was conducted to determine the effect of blade flapping on the stability and control of the XV-3 convertiplane in cruise and high-speed flight. The results of the study indicated that the inplane forces on the prop-rotors due to the blade flapping associated with airplane angular rates were in a direction to produce negative damping moments on the airplane. As a result of these inplane forces, the damping ratio of the longitudinal short period and lateral-directional oscillations approached zero at the maximum airspeed of the test airplane. ***Hervey C. Quigley and David G. Koenig.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-778, Apr. 1961, 10 pp. (TL570 Un3t Room 290)

Some Simple Solutions to the Problem of Predicting Boundary-Layer Self-Induced Pressures. Simplified theoretical approaches are shown, based on hypersonic similarity boundary-layer theory, which allow reasonably accurate estimates to be made of the surface pressures on plates on which viscous effects are important. The consideration of viscous effects includes the cases where curved surfaces, stream-pressure gradients, and leading-edge bluntness are important factors. ***Mitchel H. Bertram and Thomas A. Blackstock.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-798, Apr. 1961, 50 pp. (TL570 Un3t Room 290)

Science in Space. Dimensions and Problems: A General Review. Purposes are to review areas and opportunities for important research studies using space vehicles and to suggest what now appear to be major areas of emphasis for the national space effort. 41 pp. 1961. National Academy of Sciences, Washington, D. C. (QB501 N21.7s Over.)

Boundary-Layer Displacement and Leading-Edge Bluntness Effects in High-Temperature Hypersonic Flow. The interaction of the two effects is treated theoretically by extending the basic shock-layer concept. In the outer inviscid flow, a model consisting of a detached shock layer and an entropy layer is introduced to account for bluntness. In the boundary layer, the approximate solution is found to be governed by a local flat-plate similarity. For flat-plate afterbodies, the theory yields a solution agreeing with blast-wave theory at one limit and strong-interaction theory at the other. Flat-plate experiments in air, conducted in the C.A.L. 11 x 15-in. hypersonic shock tunnel under cold-wall conditions, included measurement of surface heat-transfer distributions and schlieren studies for zero and nonzero angle of attack. ***H. K. Cheng, J. Gordon Hall, T. C. Golian, and A. Hertzberg.*** *Journal of the Aero/Space Sciences*, v. 28, May 1961, p. 353 + 29 pages.

Artificial Earth Satellites. A collection of technical papers prepared by Soviet scientists. ***L. V. Kurnosova, editor.*** v. III, IV, and V. 576 pp. 1961. Plenum Press, Inc., New York. (TL796 Ak13itr)

* **Structure of Slow Magnetohydrodynamic Shock Waves in the Presence of Barotropic Distribution of Mass.** (*In Russian.*) O structure medlennikh magnitogidrodina micheskikh udarnykh voln pri nalichii barotropii. ***A. G. Kulikovskii.*** *Akademiia Nauk SSSR, Doklady*, v. 137, no. 4, 1961, p. 810-813.

Soviet Space Technology. Rocket background before and after the Revolution World War II efforts. The work of Ziolkovsky and other Russian scientists. German and American influence on Soviet designs and technology. Hardware, in general, and Sputniks and Luniks. ***Alfred J. Zaehringer.*** 179 pp. 1961. Harper & Brothers, New York. (TL789.8.R9 Z12s)

Investigation of Low-Subsonic Flight Characteristics of a Model of a Hypersonic Boost-Glide Configuration Having a 78° Delta Wing. Flight tests were made over an angle-of-attack range from 10° to 35° with and without artificial pitch and roll damping added. Force tests were made from −4° to 40° angle of attack to determine the static stability and control characteristics and from 0° to 30° angle of attack to determine the dynamic stability derivatives. ***John W. Paulson and Robert E. Shanks.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-894, May 1961, 31 pp. (TL570 Un3t Room 290)

Normal-Force and Hinge-Moment Characteristics at Transonic Speeds of Flap-Type Ailerons at Three Spanwise Locations on a 4-Percent-Thick Sweptback-Wing—Body Model and Pressure-Distribution Measurements on an Inboard Aileron. Aileron normal-force and hinge-moment characteristics have been obtained by strain-gage and pressure-distribution measurements for flap-type ailerons located at inboard, midspan, and outboard positions on a 45° sweptback-wing-body combination at Mach numbers from 0.80 to 1.03 and at angles of attack up to about 27°, with control deflections between approximately −15° and 15°. ***Jack F. Runckel and Gerald Hieser.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-842, May 1961, 55 pp. (TL570 Un3t Room 290)

Transonic Aerodynamic Characteristics of a Wing-Body Combination Having a 52.5° Sweptback Wing of Aspect Ratio 3 With Conical Camber and Designed for a Mach Number of $\sqrt{2}$. Tests were made in the Langley 16-foot transonic tunnel to determine the effect of conical wing camber on the aerodynamic characteristics of a wing-body combination having a 3%-thick wing, at Mach numbers from 0.80 to 1.05 and angles of attack from −4 to 14°. The cambered wing was tested with an indented body and a nonindented body. A similar plane wing was tested with the indented body. An appendix on the influence of leading-edge suction and span load efficiency on the drag-due-to-lift factors of plane and cambered wings is included. ***William B. Igoe, Richard J. Re, and Marlowe D. Cassetti.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-817, May 1961, 51 pp. (TL570 Un3t Room 290)

* **The Soviet Venus Sonde 1961 I.** The space sonde launched on Feb. 12, 1961, will fly twice near Venus. The flight of May 19-20, 1961 will occur at 180,000 kilometers from that neighbor planet. Measurement results, however, concerning Venus are not expected, since the radioequipment failed. (*In German.*) Die sowjetische Venus-Sonde 1961 I. ***Armin Wursthorn.*** *Weltraumfahrt,* v. 12, Mar.-Apr. 1961, p. 50-51.

Accuracy of Measuring Ballistic Missile Trajectories. Missile propulsion and guidance systems' performance is determined from analysis of the missile's trajectory. During powered flight, the trajectory itself is most accurately determined by radio tracking of a missile-borne beacon. The accuracy of the radio measured trajectory data must in turn be established. The standard used for comparison is the ballistic camera which presently is useful only after powered flight. Presents comparisons which establish that the radio tracking system has the capability of measuring missile position to the same order of accuracy as the ballistic camera standard. ***Frank Cooper.*** *ARS Journal,* v. 31, Apr. 1961, p. 523-526.

Rotating Pendulum Accelerometer. Describes the basic features of a new class of precision accelerometers particularly adapted to the measurement of slowly varying low-level accelerations. The approach involves computation of acceleration from measurements of changes of angular position and time. Emphasizes a comparison of this new approach with the conventional torque-balance technique used extensively in existing accelerometers. ***Samuel Schalkowsky and Henry F. Blazek.*** *ARS Journal,* v. 31, Apr. 1961, p. 469-473.

Thermostructural Design—Entry Vehicles for Mars and Venus. Thermodynamic environments for the vehicles are discussed, methods are described for computing transient structural temperatures, and thermal results for different insulations are presented. Material and strength criteria for high-temperature structures are considered, promising structural configurations are presented for entry vehicles, and the most suitable types for the example vehicles are evolved. The thermal results are then considered together with the structural results to produce the lowest weight design, and these methods are then generalized for application to any mission with any heating. ***Henry T. Ponsford, Robert M. Wood, Robert E. Lowe, and James F. Madewell.*** *ARS Journal,* v. 31, Apr. 1961, p. 474-481.

* **Rocket Propulsion.** Concludes that a rocket is the only propulsion device capable of projecting a body, no matter how small, beyond the Earth's atmosphere and, no matter what future developments bring forth, the chemical rocket will be essential for part of this process. ***J. E. P. Dunning.*** *Chemistry & Industry,* 1961, no. 13, Apr. 1, p. 380-393.

Escape From Planetary Gravitational Fields by Use of Solar Sails. The flat sail is rotated about its axis at half the revolution rate about the planet. It is assumed that the sun is the only body that provides a flux of radiant energy, and that the sail perfectly reflects this energy specularly from either surface. Under these assumptions it is found that for a practical ease of escape from Earth's gravitational field, solar sailing could accelerate a payload to escape condition in a period of time of the order of several months, during which time it would pass the vicinity of the moon's orbit about Earth. ***Norman Sands.*** *ARS Journal,* v. 31, Apr. 1961, p. 527-531.

Nuclear Electric Power for Space Missions. Covers present planning concerned with the spacecraft secondary power requirements for planetary, interplanetary, and lunar exploration. Also covers the use of electric propulsion for the final phases of propulsion to place the spacecraft at its destination. ***Terry W. Koerner and John J. Paulson.*** *Aero/Space Engineering,* v. 20, May 1961, p. 18 + 6 pages.

Ablation Mechanisms in Plastics With Inorganic Reinforcement. Experimental and theoretical studies are described which clarify the nature and importance of the chemical and physical processes that occur in the ablation of these materials. Products and amount of gas from resin pyrolysis are determined from tube furnace tests, the rate of the process is inferred, heat effects are measured by calorimetric methods, and the rate of inorganic reaction between carbon and glass is measured in an induction heated furnace. Resin decomposition during ablation and further reaction of the high-molecular weight species are treated analytically. ***Norman Beecher and Ronald E. Rosensweig.*** *ARS Journal,* v. 31, Apr. 1961, p. 532-539.

Nuclear Rocket Stages Increase SATURN's Payload Capability. Through the use of orbital refueling operations, nuclear rocket stages could provide the necessary transportation for manned lunar operations. ***Willis Y. Jordan, Jr., Donald R. Saxton, and Paul G. Thomas.*** *Aero/Space Engineering,* v. 20, May 1961, p. 14 + 4 pages.

Experimental Investigation of Stage Separation Aerodynamics. Interstage aerodynamic pressures on a two-stage missile model with a cold-air simulated second-stage rocket motor were investigated over a range of separation distances to 3 second-stage body diameters at Mach 2 and a pressure altitude of 38,000 ft in the 8- by 6-ft tunnel. Effects of stage centerline misalignment were also studied. First-stage interference effects produced higher-than-ambient second-stage base pressures over a longer separation distance for jet-off staging than for jet-on. ***Robert A. Wasko.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-868, May 1961, 24 pp. (TL570 Un3t Room 290)

Data Capsule Ejection Through a Re-Entry Body Wake. Initial ejection velocities must be sufficiently large to ensure escape of the capsule from the nose cone. Specifically, the ICBM Mark 2 nose cone and associated R&D data capsule were studied to ascertain quantitatively the integrated wake/capsule interaction phenomena that occur during separation of the two bodies. ***Leonard C. MacAllister and Anthony M. Smith.*** *Aero/Space Engineering,* v. 20, May 1961, p. 8 + 4 pages.

AGRICULTURE

Herbicide Metabolism. Absorption and Metabolism of Aminotriazole in Cotton. Investigations of the absorption and metabolism of aminotriazole in cotton plants were undertaken to determine if the material was translocated into cottonseed when used as a cotton defoliant. Experiments indicated that 3-amino-1,2,4-triazole was metabolized by the leaves and that the metabolites were translocated in small quantities to the seed. ***Charles S. Miller and Wayne C. Hall.*** *Journal of Agricultural and Food Chemistry,* v. 9, May-June 1961, p. 210-212.

Energy Requirements for Forming Hay Pellets. A laboratory pelleting device was constructed to provide a means of measuring energy requirements for compressing whole hay for a short pressure-application hold time. The investigation was concerned with hay having a moisture content below 25% and

with pelleting pressures of approximately 3,500 psi and lower. ***P. L. Bellinger and H. F. McColly.*** *Agricultural Engineering,* v. 42, May 1961, p. 244 + 4 pages.

Reducing Reservoir Evaporation. Application of surface films cuts losses. ***F. R. Crow.*** *Agricultural Engineering,* v. 42, May 1961, p. 240-243.

BIOCHEMISTRY AND BIOPHYSICS

*** Antibody Formation. I. The Suppression of Antibody Formation by Passively Administered Antibody. II. The Specific Anamnestic Antibody Response. *Jonathan W. Uhr and Joyce B. Baumann.*** *Journal of Experimental Medicine,* v. 113, May 1961, p. 935-970.

Gene Evolution and the Haemoglobins. *Vernon M. Ingram.* *Nature,* v. 189, Mar. 4, 1961, p. 704-708.

Submolecular Structure of the Nucleic Acids. *Bernard Pullman and Alberte Pullman.* *Nature,* v. 189, Mar. 4, 1961, p. 725-727.

*** How Motions Are Seen by Insects.** (*In German.*) Wie sehen Insekten Bewegungen. ***Bernhard Hassenstein.*** *Naturwissenschaften,* v. 48, no. 7, Apr. 1961, p. 207-214.

*** The Dynamics of Viral Functions.** The Leeuwenhoek Lecture. ***A. Lwoff.*** *Royal Society, Proceedings,* v. 154, ser. B, Apr. 18, 1961, p. 1-20.

*** A Theory of Drug Action Based on the Rate of Drug-Receptor Combination.** The properties of a drug can be specified by two rate constants: k_1, the association rate constant, and k_2, the dissociation rate constant; the ratio $k_2/k_1 = k_e$ corresponds to the reciprocal of the "affinity". The value of k_e then determines potency, and k_2 determines whether the drug is a powerful stimulant (k_2 high), a partial antagonist with ability both to excite and to antagonize (k_2 moderate) or an antagonist with vestiges of stimulant action (k_2 low). Qualitatively, such a theory accounts for the persistence of effect of an antagonist on a tissue; for the characteristic sequence of excitation followed by block with drugs such as nicotine; for certain forms of achyphylaxis; and for the vestiges of stimulant action possessed by classical antagonists. ***W. D. M. Paton.*** *Royal Society, Proceedings,* v. 154, ser. B, Apr. 18, 1961, p. 21-69.

*** Synthesis of Ribonucleic Acid in the Nucleolus. *J. L. Sirlin, K. Kato, and K. W. Jones.*** *Biochimica et Biophysica Acta,* v. 48, no. 2, Apr. 1, 1961, p. 421-423.

*** Nucleotide Metabolism in the Bone Marrow of Normal and X-Ray Irradiated Animals.** Enzymatic breakdown of *RNA* by bone marrow extracts in phosphate buffer is inhibited approximately twofold one day after local X-ray irradiation of the rabbit limb with a 2000 *r* dose. The content of acid soluble purine and pyrimidine compounds in the bone marrow of the irradiated limb (2000 *r*) somewhat increases after 2 hours and then drops appreciably toward the 3rd day thereafter it approaches the normal level on the 9th day. Autolytic splitting of nucleic acid in the bone marrow irradiated under similar conditions decreases 2-3-fold after 7 hours and later. (*In Russian.*) Obmen nukloetidov v kostnom mozgu v norme i posle rentgenovskogo oblucheniia. ***G. A. Kritskiĭ and F. I. Roĭtman.*** *Biokhimiia,* v. 26, no. 1, Jan.-Feb. 1961, p. 148-154.

*** On the Mechanism of the Oxygen Effect in Irradiated Proteins.** In cysteine solutions, the magnitude of the oxygen effect can vary from a maximum (about 3.1) to complete lack of effect according to the ratio of the substrate concentration to the irradiation dose. This characterizes the conventional significance of the oxygen effect (for various cell areas, different characters of the process, etc.). In protein solutions the magnitude of the oxygen effect is largely defined by the hydrogen bonds of SH-groups. (*In Russian.*) O mekhanizme kislorodnogo effekta pri obluchenii belkov. ***T. E. Pavlovskaia and A. G. Pasynskiĭ.*** *Biokhimiia,* v. 26, no. 1, Jan.-Feb. 1961, p. 110-119.

*** The Effect of Mutation in a Structural Gene on the Inducibility of the Enzymes Controlled by Other Genes of the Same Operon. *Hiroshi Nikaido and Toshio Fukasawa.*** *Biochemical and Biophysical Research Communications,* v. 4, no. 5, Apr. 1961, p. 338-342.

*** The Directing Role of DNA in RNA Synthesis.** Ribonucleotide incorporation into RNA shows base ratios which reflect the base composition of the DNA; and with Poly T as inducer a Poly A polymer is formed even when the other RNA precursors are present. ***J. J. Furth, Jerard Hurwitz, and Monika Goldmann.*** *Biochemical and Biophysical Research Communications,* v. 4, no. 5, Apr. 1961, p. 362-367.

*** The Antiviral Drug Interferon.** Interferon, a drug possessing the antiviral properties of a broad-spectrum antibiotic was obtained through the reciprocal action of the A influenza virus strain PR_8 and the cells of the chorioallantoic membrane of chick embryos. Interferon is not toxic to chick embryos, white mice and tissue cultures. Interferon administered 24 hours prior the infection prevents the propagation of the influenza and small pox vaccine viruses developing in the chick embryos. In tissue cultures interferon hampers the propagation of viruses of polyomyelitis, measles, and adenoviruses. (*In Russian.*) Protivovirusnyĭ preparat interferon. ***Z. V. Ermol'eva, N. M. Furer, T. I. Balezina, L. L. Fadeeva, and B. M. Nemirovskaia.*** *Antibiotiki,* v. 6, no. 3, Mar. 1961, p. 196-200 + 3 plates.

*** Some Problems Concerning the Securing of Life Activity Conditions During Cosmic Flight (Nutrition, Water Production, Air Regeneration, Sanitation).** (*In Russian.*) Nekotorye voprosy obespecheniia uslovīĭ zhiznedeiatel'nosti pri kosmicheskom polete (pitanie, vodoobespechenie, regeneratsiia vozdukh assenizatsiia). ***A. A. Giurdzhian.*** *Uspekhi Sovremennoĭ Biologii,* v. 51, no. 1, Jan.-Feb. 1961, p. 74-83.

Perception of Distance in Animal Echo-Location. Three separate commentaries by the listed authors. ***L. Kay, J. D. Pye, and Jan Nordmark.*** *Nature,* v. 190, Apr. 22, 1961, p. 361-364.

A Chemical Basis for the Classification of Animal Viruses. A taxonomy for animal viruses based on type of nucleic acid and essential labile lipid content appears less arbitrary and genetically more stable than those previously suggested, and may provide a useful means of ordering viruses. ***P. D. Cooper.*** *Nature,* v. 190, Apr. 22, 1961, p. 302-305.

Mechanisms of Expression of Genetic Information. *Wendell M. Stanley and Robert M. Bock.* Nature, v. 190, Apr. 22, 1961, p. 299-300.

Mechanisms of Inactivation of Deoxyribonucleic Acids by Heat. Two processes are found, in accordance with previous workers. The first, or "collapse", process is apparently the actual separation of the complementary strands of the DNA and leads to a rapid and kinetically complex loss of from 93 to 98% of the activity. The remaining few per cent of activity is apparently inherent in the denatured DNA and does not depend on "renaturation". The other process, the "single-hit" process, is a first-order reaction that apparently proceeds only at those base-pairs that are open as a result of thermal excitation, and hence its rate increases anomalously fast with temperature in the temperature region just below that at which the collapse occurs. It seems likely that the first-order reaction is the loss of a purine from one of the strands. ***William Ginoza and Bruno H. Zimm.*** *National Academy of Sciences, Proceedings,* v. 47, May 1961, p. 639-652.

*** Echolocation by Bats.** The author suggests a probable mechanism based on a general theory applicable to nearly all Microchiroptera. ***J. D. Pye.*** *Endeavour,* v. 20, no. 78, Apr. 1961, p. 101-111.

The Haemoglobin Particles. Chemical and Genetic Aspects of Their Structure. Presents a summary of work on the primary structure of human hemoglobin A which was begun five years ago in the Max-Planck-Institut für Biochemie. ***G. Braunitzer, et al.*** *Nature,* v. 190, May 6, 1961, p. 480-482.

*** Treatment of Laryngeal Papillomas With Bovine Wart Vaccine.** A preliminary report of four cases. ***E. W. Irvine, Jr., E. S. Irvine, and O. P. Moffitt, Jr.*** *Cancer,* v. 14, no. 3, May-June 1961, p. 636-638.

* **Mathematical Models for the Product Accumulation in Microbiological Processes.** A production model consisting of one or more exponential decay functions is proposed to represent the rate of accumulation of a product per unit weight of cell. This, together with a cell age distribution function, is used to describe the product accumulation in a fermentation process. This postulate offers a unified concept applicable to both batch and continuous processes as well as problems arising from environmental changes. ***Ping Shu.*** *Journal of Biochemical and Microbiological Technology and Engineering*, v. 3, no. 1, Apr. 1961, p. 95-109.

Relation Between RNA, DNA, and Protein Syntheses in the Replicating Nucleus of *Euplotes*. Localization and synthesis of RNA, DNA, and protein have been studied in the replicating nucleus of *Euplotes*. At the reorganization band, DNA undergoes in succession two marked changes in organization. DNA shifts from a granular state to a dispersed form and finally becomes very dilute; at the time the latter condition is reached, DNA synthesis takes place. Histidine incorporation is heavy only in the region of DNA synthesis. RNA is essentially completely destroyed or eliminated from the nucleus just ahead of the advancing wave of DNA synthesis. Neither RNA synthesis nor RNA are detectable in the zone of DNA synthesis. ***D. M. Prescott and R. F. Kimball.*** *National Academy of Sciences, Proceedings*, v. 47, May 1961, p. 686-693.

On the Participation of DNA in RNA Biosynthesis. Experiments are described in which the nearest neighbor to cytidylate and base composition was determined for RNA synthesized by a partially purified bacterial enzyme which requires DNA. The results show that different DNAs alter the position of cytidylate in the newly assembled RNA chain and that the ribopolynucleotide has an average base composition similar to the "primer" DNA used. ***Samuel B. Weiss and Tokumasa Nakamoto.*** *National Academy of Sciences, Proceedings*, v. 47, May 1961, p. 694-697.

The Thermostatic Control of Human Metabolic Heat Production. By cranial thermometry combined with indirect and direct calorimetry, the two mechanisms of human "chemical" and "physical" temperature regulation have been experimentally resolved in terms of metabolic, sudomotor, and vasomotor responses of reproducible magnitude to the degree of cold-stimulation at thermoreceptive nerve endings of the skin and warm-stimulation of an extremely sensitive, centrally located thermoreceptive organ. It is concluded that the function of the "heat maintenance center" in the posterior hypothalamus is synaptic, relaying activity of increasing frequency from thermoreceptive endings in the skin for increasing response by metabolic heat production. This center is indifferent to the stimulus of temperature. The "heat loss center" in the anterior hypothalamus, however, acts as a terminal receptor organ for temperature, comparable to the retina, the anatomically related receptor organ for light. This organ controls not only the direct responses to heat by vasodilatation and sweating but also through a third efferent pathway, afferent to the "heat maintenance center", it indirectly controls, with counteracting impulses, the response by metabolic heat production to cold-stimulation of the skin. ***T. H. Benzinger, A. W. Pratt, and Charlotte Kitzinger.*** *National Academy of Sciences, Proceedings*, v. 47, May 1961, p. 730-739.

* **The Effect of X-Irradiation on Various Mouse Strains Due to Their Genetic Background. I. Lethality After Acute Irradiation.** Acute whole-body irradiation of male mice from an albino strain and from CBA gave an $LD_{50(30)}$ of 446 r and 748 r, respectively; for the F_1 between them, 670 r, and for the F_2, 670 r. Comparison between C3H and CBA gave 668 r and 748 r, respectively; for the F_1, 725 r, and for the F_2, 745 r. The results show that the resistance cannot be ascribed solely to the action of dominant genes. ***H. Frölén, K. G. Lüning, and C. Rönnbäck.*** *Radiation Research*, v. 14, no. 4, Apr. 1961, p. 381-393.

Developing Cell Systems and Their Control. This volume includes the contributions to the Eighteenth Symposium of the Society for the Study of Development and Growth. At this symposium advances in the knowledge of cell differentiation and its control within the organism, from both the biological and biochemical points of view, were presented and described. There are nine reports of original studies of the cellular aspects of organization; pathways of hormone action on responding cellular systems; chemical control of regeneration by the nervous system in Amphibia; the mitotic cycle; structural localization of active molecules within cells; and genetic control of protein synthesis. ***Dorothea Rudnick, editor.*** 240 pp. 1960. The Ronald Press Co., New York. (QH511 So13dc)

Introduction to Quantitative Genetics. An introductory textbook of quantitative genetics, with the emphasis on general principles rather than on practical application, and one that can be understood by biologists of no more than ordinary mathematical ability. ***D. S. Falconer.*** 365 pp. 1960. The Ronald Press Co., New York. (QH431 F18i)

* **Exciting New Tools for Anticancer Drug Investigation.** Describes a series of tumors in hamsters which have biological characteristics closer to the human cancer picture than most of the animal tumor systems available prior to this time. ***F. M. Schabel, Jr.*** *Southern Research Institute, Bulletin*, v. 14, no. 1, 1961, p. 4-8.

Carcinogenesis. Critically reviews theories of carcinogenesis and discusses carcinogens and their chemical structure. ***I. Hieger.*** 138 pp. 1961. Academic Press, New York. (RC262 H53c)

* **Restoration of Muscles Affected by X-rays Under Conditions of Transplantation of Minced Muscular Tissue.** The restoration process in the muscular tissue, subjected to a one-time local radiation (2000 r), takes place with more intensity during transplantations of minced muscular tissue than during a simple section of the muscle. This is expressed by the rapid cessation of the degeneration process, by an intense development of young muscular elements and by a large amount of newly-formed muscular fibers in the last moments of the restoration process. It may be stated that the considerable damage caused by mincing exerts a stimulating influence on the regeneration process of the irradiated muscular tissue. After transplantation of minced muscular tissue, not all the fragments of this tissue degenerate; some can live and be regenerated. There is a great increase of the amount of ribonucleic acid in these parts. During the early stages of the regeneration process the RNA accumulation is higher on the side of the minced muscular tissue transplantation. Apparently the exchange of substances in this case is more intensive. (*In Russian.*) Vosstanovlenie myshts, porazhennykh rentgenovskimi luchami, posle peresadki izmel'chennoĭ myshechnoĭ tkani. ***Van Ciu-Bi.*** *Akademiia Nauk SSSR, Doklady*, v. 137, no. 3, Mar. 1961, p. 735-738 + 1 plate.

* **Some Observations on Interferon Prepared in Tissue Cultures.** Interferon was prepared in rhesus monkey kidney, calf kidney, human adult thyroid, and in human amnion tissue cultures by the inoculation of live influenza A virus. When assayed in heterologous tissue cultures, the presence of cellular specificities of different degree became evident. Interferon prepared in rhesus monkey kidney tissue cultures was active in all cultures in which it was assayed, unlike that prepared in human amnion cultures, which was only active when assayed in homologous tissue cultures. ***R. N. P. Sutton and D. A. J. Tyrrell.*** *British Journal of Experimental Pathology*, v. 42, no. 2, Apr. 1961, p. 99-105.

CERAMICS AND CONCRETE

Thermal Expansion of Alpha Alumina. Accurate thermal expansion coefficients were obtained and compared with other published values. ***William J. Campbell and Clark Grain.*** *U. S. Bureau of Mines Report of Investigations* 5757, 1961, 16 pp. (TN21 Un3r Room 290)

* **Effects of the Conditions of the Deposition of Hydroxide on the Mechanical Strength of Aluminum Oxide.** The mechanical strength of aluminum oxide is due to the homogeneity of the hydroxide precipitate. The degree of the chemical homogeneity is determined by the pH value of the medium and temperature during deposition. With the same degree of chemical homogeneity of the aluminum oxide, its stability drops with increase in porosity. Optimum conditions are suggested for the preparation of aluminum oxide with mechanical strength. (*In Russian.*) Vliianie uslovīĭ osazhdeniia gidrookisi na mekha-

nicheskuiu prochnost' okisi aliuminiia. ***Ia. R. Katsovashvili, et al.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk,* 1961, no. 2, Feb., p. 245-250.

Polar-Screen Theory for the Deflocculation of Suspensions. Measurements were made of the deflocculation of alumina in both polar and nonpolar liquids using various acids, bases, and electrolytes. The pH of suspensions was found to be temperature-dependent, the pH decreasing with increasing temperature. The results of these experiments are not compatible with the double-layer theory for the deflocculation of suspensions. The polar-screen theory explaining deflocculation by the hydrogen bonding of polar ions or molecules to electronegative surfaces is presented. The polar ions or molecules provide the surfaces with a charged screen. ***Arthur E. Lewis.*** *American Ceramic Society, Journal,* v. 44, May 1, 1961, p. 233-239.

The Examination of Clays by IL/MA. "IL" is the combined water of the clay mineral, and "MA" is its capacity for moisture adsorption under standard conditions. The procedure for determining these values is described. When IL is plotted against MA, the points for each geological formation occupy a sector, depending on the nature and degree of variation in the clay mineral; in any sample the nature and proportion of the clay mineral can be estimated. From this and from the proportion of carbonaceous material and carbonate obtained in the course of determining IL it is possible to assess some of the properties and likely behavior of the clay. ***P. S. Keeling.*** *British Ceramic Society, Transactions,* v. 60, Apr. 1961, p. 217-244.

On the Growth of Sapphire Microcrystals. Thermodynamical considerations on the vapor-phase growth of whisker and platelet crystals of α-Al_2O_3 by the oxidation of Al lead to the conclusion that the vapor-phase mass transport is probably due to the suboxide Al_2O and not AlO as previously suggested. Electron microscope observations confirm the optical evidence that spiral growth steps do not occur on the (0001) surfaces of Al_2O_3 crystals grown in this way. ***C. M. Hargreaves.*** *Journal of Applied Physics,* v. 32, May 1961, p. 936-938.

High Temperature Mechanical Properties of Ceramic Materials. III. Vitrified Chemical and Refractory Porcelains. The variation of transverse strength and elastic modulus with temperature was determined for two commercial porcelains, PC-15, a chemical porcelain, and MV-30, a refractory porcelain commonly used for pyrometer protection tubes and similar applications. ***G. K. Dunsmore, J. E. Fenstermacher, and F. A. Hummel.*** *American Ceramic Society Bulletin,* v. 40, May 15, 1961, p. 310-313.

Refractories for Uranium Reduction. Commercially available refractory materials were investigated not only for inertness toward the reactants and products of the reduction of UF_4 by Mg but also for contamination of the metal by undesirable impurities. High purity MgO-Al_2O_3 spinel was found to be a satisfactory material for fabrication into containers for the reduction process. ***C. Arne Arenberg, Carl W. Boquist, and O. R. Magoteaux.*** *American Ceramic Society Bulletin,* v. 40, May 15, 1961, p. 304-307.

Reactive Hot Pressing of ZrC-UC Solid Solution. High density pellets were made by reactive hot pressing, wherein the proper amounts of ZrC, UO_2, and graphite powders were placed in a graphite die, allowed to react at about 2000 C in a vacuum or argon, and were then pressed to form the desired ZrC-UC pellet. The addition of 1 wt.% Ni enhanced grain growth, but the Ni did not remain in the final product. ***Paul Stephas and E. W. Hoyt.*** *American Ceramic Society Bulletin,* v. 40, May 15, 1961, p. 320-323.

Fused Silica Ceramics. Discusses the advantages and applications of this type of ceramic materials. The author concludes that the fused silica market has reached only a fraction of its potential size. ***J. D. Walton.*** *Ceramic Age,* v. 77, no. 5, May 1961, p. 52-58.

CHEMICAL ENGINEERING

*** Safety Measures in Gas Chromatography When Using Hydrogen as the Carrier Gas.** The use of removal plates at the back wall of the furnace chamber of heatable gas chromatographs, the wetting of the furnace chamber with N and the throttling of the H amount were recommended. (*In German.*) Sicherheitsmassnahmen in der Gaschromatographie bei Verwendung von Wasserstoff als Trägergas. ***U. Schwenk and H. Hachenberg.*** *Brennstoff-Chemie,* v. 42, no. 3, Mar. 1961, p. 72-74.

*** The Upward Vertical Flow of Oil-Water Mixtures.** Studies were made in a 37-ft. length of cellulose acetate butyrate tubing of 1.038-in. i.d. Flow pattern, holdup and pressure-drop data were obtained for water mixtures with 0.936, 20.1 and 150 centipoise oils at superficial water velocities ranging from 0.10 to 10.0 ft./sec. ***G. W. Govier, G. A. Sullivan, and R. K. Wood.*** *Canadian Journal of Chemical Engineering,* v. 39, no. 2, Apr. 1961, p. 67-75.

*** Multiple Layer Insulation for Cryogenic Applications.** Best results have been obtained using Al foil separated by layers of fiber glass paper. ***R. H. Kropschot.*** *Cryogenics,* v. 1, no. 3, Mar. 1961, p. 171-177.

*** Optimum Process Conditions for a Completely Mixed Multistage Reactor.** A graphical method for determining the process conditions which give the minimum volume of reactor at a given outlet conversion is described and illustrated by application to a multistage fluidized bed reactor for the catalytic oxidation of SO_2. ***H. Kubota, S. Namkoong, T. Akehata, and M. Shindo.*** *Canadian Journal of Chemical Engineering,* v. 39, no. 2, Apr. 1961, p. 64-66.

*** Thermal Cracking of Acetone. I. Influence of the Process Variables on the Product Distribution. II. Deriving Rate-Equations From Non-Isothermal Flow Experiments.** Conversions and selectivities are correlated vs. the total acetone conversion in a diagram valid for the whole temperature range investigated. ***G. Froment, H. Pijcke, and G. Goethals.*** *Chemical Engineering Science,* v. 13, no. 3, Feb. 1961, p. 173-189.

Heterogenous Catalysis, Results and Projects for Research. A large number of comparatively recent effects are surveyed which indicate that there are many roads open for catalytic research and to technical applications. ***J. Arvid Hedvall.*** *Chalmers Tekniska Högskolas Handlingar,* no. 233, 1961, 18 pp. (T4 C35t Vis.)

*** Sulphur Production From Canadian Sour Gas.** ***H. W. Manley.*** *Canadian Mining and Metallurgical Bulletin,* v. 54, no. 587, Mar. 1961, p. 236-240.

Gasoline Sweetening Process With Molecular Sieves. Developments of this adsorption process has led to a commercial unit. Here are the effects of operating variables and aging studies. ***Kenneth H. Bacon and Alfred M. Henke.*** *Petroleum Refiner,* v. 40, Apr. 1961, p. 109-112.

Adsorption Unit Recovers 99.6% Pentanes-Plus. Recovery by the first Liquigen process unit, using activated carbon and steam regeneration. ***George F. Russell.*** *Petroleum Refiner,* v. 40, Apr. 1961, p. 103-106.

Impervious Carbon and Graphite in HF Processing. Can be used for processing aqueous HF below concentrations of 50% up to 338 F and are excellent for equipment, but piping systems must be carefully designed. ***Vance B. Brown.*** *Chemical Engineering Progress,* v. 57, Apr. 1961, p. 69-73.

Materials for Extreme Service. Current trends in chemical process service conditions mean that traditional concepts of materials stability, strength and ductility will have to be modified radically to meet projected future requirements. ***E. A. Kachik.*** *Chemical Engineering Progress,* v. 57, Apr. 1961, p. 65-68.

*** The Influence of Gas Liberation on Heat Transfer in the Heating of Liquids.** Experimental results in a horizontal and vertical double-tube heat exchanger show an increase in heat exchange up to 15% in the transition region between laminar and turbulent flow. (*In German.*) Einfluss der Gasausscheidung auf den Wärmeübergang bei der Erwärmung von Flüssigkeiten. ***B. Métais.*** *Chemie-Ingenieur-Technik,* v. 33, Mar. 1961, p. 182-184.

*** The Formation and Conditions for Formation of Natural and Synthetic Diamonds and Other Natural and Synthetic High-Pressure/High-Temperature Phases.** Fields of applica-

tion for the new high-pressure/high-temperature technology in science, industry and nature are outlined: new syntheses, high-pressure transformations, pressure syntheses, high-pressure transformations, spread of fields of state, high-pressure sintering. (*In German.*) Über die Bildung und Bildungsbedingungen der natürlichen und synthetischen Diamanten und anderer natürlicher und synthetischer Hochdruck-Hochtemperatur-Phasen. ***A. Neuhaus.*** *Chemie-Ingenieur-Technik*, v. 33, Mar. 1961, p. 220-224.

* **Synthetic Gemstones.** Review is confined to synthetic crystals and does not include imitation gems, or gem materials of amorphous, polycrystalline or organic nature. ***E. A. D. White.*** *Chemical Society, Quarterly Reviews*, v. 15, no. 1, 1961, p. 1-29 + 4 plates.

Silver—A Material of Construction for Handling Hydrochloric Acid and Ammonium Chloride. Advantages are enumerated. ***C. Auchmoody.*** *Engelhard Industries Technical Bulletin*, v. 1, no. 4, Mar. 1961, p. 135.

* **The Water Supply Problem.** Desalting of saline water is one answer with a bright future, and an attractive energy source for this process is low-grade heat from steam electric plants. Three plants are described. *Power Engineering*, v. 65, Apr. 1961, p. 52-57.

* **High Pressure Equipment: Some Notes.** Two recent examples cited are Cominco's urea synthesis plant at Calgary which operates at 2400-3000 psi and Union Carbide's Montreal polyethylene plant which goes up to 40,000 psi. ***Maurice Conklin.*** *Canadian Chemical Processing*, v. 45, Apr. 1961, p. 101-102.

* **Reaction of Allyl Derivatives With Acetylene and CO. V. A New Method of Catalytic Carboxylation.** A new method of carboxylation is described, based on the use of catalytically active Ni compounds. (*In Italian.*) Reazioni dei derivati allilici con acetilene e ossido di carbonio. V. Un nuovo metodo di carbossilazione catalitica. ***Gian Paolo Chiusoli and Sergio Merzoni.*** *Chimica e l'Industria*, v. 43, Mar. 1961, p. 259-262.

* **Commercial High Vacuum Short-Path Distillation.** Inherent advantages of the centrifugal molecular still design have permitted chemical producers to extend the use of this equipment to the purification of many classes of heat-sensitive organic compounds previously believed to be undistillable. (*In French and English.*) La distillation moléculaire industrielle. ***K. Lohwater and H. Eckstein.*** *Vide*, v. 16, no. 91, Jan.-Feb. 1961, p. 44-53.

* **Isomerization Processes for Gasolines.** Isomerization processes are categorized into two main types depending upon the catalyst used. When catalysts of the aluminum halides type are used, the transformation occurs in liquid phase at a relatively low temperature, about 100 C. In industry, the catalyst used is aluminum chloride. (*In French.*) Procédés d'isomérisation des essences. ***C. Thonon.*** *Institut Francais du Pètrole, Revue et Annales des Combustibles Liquides*, v. 16, Feb. 1961, p. 161-183.

* **Functional Analysis of Manufacturing Processes in Chemical Industry.** (*In French.*) L'analyse fonctionnelle des procédés de fabrication dans l'industrie chimique. ***J. Cathala.*** *Chimie & Industrie (Gènie Chimique)*, v. 85, no. 3, Mar. 1961, p. 77-84.

Saline Water Conversion Report for 1960. Fundamental research efforts have produced good and useful results, and new knowledge has been developed. Additional work on various phenomena and potential processes carried on during the current year includes research in organic and inorganic hydrates, scale formation and its alleviation, ion-selective and ion-restraining membranes, corrosion, theoretical investigations, and others. Projects are described. 135 pp. Jan. 1961. U. S. Department of the Interior, Washington, D. C. (QH88 Un3.4a)

Proceedings of the Fourth Conference on Carbon. Contains the authoritative proceedings of the fourth conference on carbon, co-sponsored by the American Carbon Institute and the University of Buffalo. Conferees represented university, government and industrial laboratories which study carbon by physical or chemical methods and whose interests encompass manufacture, properties and use of carbonaceous materials.

Here carbon is considered broadly to include such materials as diamond, graphite, electrode carbons, carbon black and activated carbons. 778 pp. 1960. Pergamon Press, New York. (QD181.C1 C76p)

Silicones. Presents current information on the subject by providing a condensed, fully documented account of organosilicon chemistry together with a systematic treatment of manufacturing processes and the applications of silicones. ***S. Fordham, editor.*** 252 pp. 1961. Philosophical Library Inc., New York. (TP248.S5 F75s)

Water Desalting: Push Is on. Reports significant gains made in converting salt water to fresh water. Cost continues to be the big problem. ***K. W. Bennett.*** *Iron Age*, v. 187, no. 19, May 11, 1961, p. 82-83.

Designing Temperature-Stable Reactors. A slight change in tubular-reactor conditions may cause uncontrolled temperature rise in exothermic reactions. Here's how to prevent it ahead of time. ***Peter Harriott.*** *Chemical Engineering*, v. 68, May 15, 1961, p. 165-170.

* **Technical Flow Model Experiments on Oil Cracking Plants.** With the aid of model experiments an impeller and the internal construction of the generator have been developed which ensure the physical homogeneity of the generator contents. (*In German.*) Strömungtechnische Modellversuche an Ölspaltanlagen. ***G. Hilgers and R. Wille.*** *Chemie-Ingenieur-Technik*, v. 33, Apr. 1961, p. 251-254.

The Anatomy of Fluidized Beds. Covers gas flow patterns, particle movement, and bubble formation. ***P. N. Rowe.*** *Industrial Chemist*, v. 37, Apr. 1961, p. 167-169.

Chromatography Can Increase Alkylation Efficiency. It is both feasible and economical to continuously analyze five streams with one chromatograph for eight common components. ***John H. Williams, Jr. and Ray L. Wilt.*** *Oil and Gas Journal*, v. 59, no. 20, May 15, 1961, p. 134-137.

CHEMISTRY—ANALYTICAL (ORGANIC AND INORGANIC)

* **Potentiometric and High-Frequency Titration of Trace Amounts of Chlorides and Mercaptans.** It is shown that the two techniques, while being simpler than the amperometric methods hitherto used, give similar results with respect to sensitivity and accuracy. By means of potentiometry, mixtures of chlorides and mercaptans can be analyzed. This method can also be used for the determination of traces of chloride in concentrated aqueous salt solutions. ***N. van Meurs.*** *Journal of Electroanalytical Chemistry*, v. 2, no. 1, Jan.-Feb. 1961, p. 17-24.

* **The Determination of Uranium in Sea Water by Pulse Polarography.** The uranium is first separated and concentrated from 4 liters of sea water by solvent extraction with di-(2-ethylhexyl)-phosphoric acid in carbon tetrachloride. A further purification of the uranium is carried out by the extraction of uranyl nitrate into ethyl acetate, and the uranium concentration is found by pulse polarography using the peak from a perchloric acid-tartrate supporting electrolyte. Uranium-237 is employed as a radioactive tracer to measure the percentage recovery of uranium in the chemical separation processes. ***G. W. C. Milner, J. D. Wilson, G. A. Barnett, and A. A. Smales.*** *Journal of Electroanalytical Chemistry*, v. 2, no. 1, Jan.-Feb. 1961, p. 25-38.

* **Analytical Chemistry of Semiconductors.** ***T. S. Burkhalter.*** *Analytical Chemistry*, v. 33, May 1961, p. 21A + 9 pages.

Analysis of Pyrolyzates of Polystyrene and Poly(methyl Methacrylate) by Gas Chromatography. Analysis of the composition of the pyrolyzates of polystyrene and poly(methyl methacrylate) degraded at temperatures ranging from 400 to 1100 C was accomplished by gas chromatography. Styrene monomer is the major product in the degradation of polystyrene below 700 C. Poly(methyl methacrylate), below 450 C, de-

polymerizes nearly exclusively to monomer. ***Frank A. Lehmann and Gerhard M. Brauer.*** *Analytical Chemistry*, v. 33, May 1961, p. 673-676.

a

* **Method of Analysis of In-As-Se Alloys.** Selenium is determined by gravic method after reduction with sulfur dioxide. Arsenic is determined by evaluating the bromate in the presence of In in the same solution in which In is determined by evaluation of trilon. The error involved is ~1.5%; the analysis lasts four hours. (*In Russian.*) Metodika analiza splavov In-As-Se. ***G. A. Kaliuzhnaia and A. S. Khalonin.*** *Zavodskaia Laboratoriia*, v. 27, no. 3, 1961, p. 261-263.

* **Microdetermination of Selenium by Diphenyldipiazselenol Polarography.** The synthesis of diphenyldipiazselenol by reaction of SeIV and 3,3′-diamino-benzidine is quantitative with low concentrations. In aqueous and alkaline solutions the Se-containing derivatives give 2 polarographic waves. In the same media the current of diffusion of each wave is proportional to the concentration of the diphenyldipiazselenol within the range of solubility of this compound. (*In French.*) Microdosage du sélénium par polarographie du diphényldipiazsélénole. ***Claude Le Peintre.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 252, no. 13, Mar. 27, 1961, p. 1968-1970.

b

* **Rapid Method of Determining Barium in Glasses.** After dissolving glass in a mixture of chloric and fluoric acids and after deposition of sesquioxides, the sum of Ba, Ca, and Ng is titrated in an aliquot part of the filtrate with trilon in the presence of Eriochrome Black. The Ba content is calculated by difference. (*In Russian.*) Bystryĭ metod opredeleniia bariia v steklakh. ***E. Minchevski, Ia. Frydel', and Z. Marchenko.*** *Zavodskaia Laboratoriia*, v. 27, no. 3, 1961, p. 277-279.

c

* **Gravimetric Method for the Quantitative Determination of Cyanuric Acid in the Form of Complex Diammocupric Salt.** The concentration of cyanuric acid was about 0.025 mol/l, the molar ratio $C_3H_3O_3N_3:NH_3=1:6$ and there was a low excess of ions $[Cu(NH_3)_4]^{2+}$. Cold precipitation was accelerated by the addition of 10% of 96% alcohol per volume to the 10% solution. The probable error was ±13%. The maximum error was ±1.08%. (*In Rumanian.*) Metodă gravimetrică de dozare a acidului cianuric sub forma sării complexe diamocuprice. ***G. Ostrogovich and A. Nemeș.*** *Academia Republicii Populare Romine, Baza de Cercetări Științifice, Studii și Cercetări, Științe Chimice*, v. 7, nos. 3-4, July-Dec. 1960, p. 285-293.

d

Solution-Flame Photometric Determination of Lithium in Lithium Minerals. The sample is decomposed by repeated treatments with nitric, hydrofluoric, and perchloric acids. ***V. M. Benson, J. L. Kassner, E. E. Creitz, and H. A. Ice.*** *U. S. Bureau of Mines Report of Investigations* 5755, 1961, 10 pp. (TN21 Un3r Room 290)

e

* **The Separation of Sub-Microgram Amounts of Uranium From Milligram Amounts of Iron, Aluminium and Plutonium.** Fluorimetric determination based on mixing a sample with a strong hydrochloric acid solution containing hydriodic acid. Only the uranium is retained on the resin and it can subsequently be eluted with dilute hydrochloric acid. ***D. G. Boase and J. K. Foreman.*** *Talanta*, v. 8, no. 4, Apr. 1961, p. 187-190.

f

* **The Analysis of Beryllium and Beryllium Oxide. VI. The Determination of Tantalum and Niobium.** Niobium and Ta are determined spectrophotometrically. For Nb, the method is accurate to ±5% or 10 μg and for Ta accurate to ±10% or 30 μg. No interference was caused by the presence of 10-mg amounts of 68 elements. ***James O. Hibbits, H. Oberthin, R. Liu, and Silve Kallmann.*** *Talanta*, v. 8, no. 4, Apr. 1961, p. 209-213.

g

* **Spectrophotometric Determination of Palladium With Nitrilotriacetic Acid.** Discusses influence of pH, ionic strength, and palladium and nitrilotriacetic acid concentrations. Evidence is given for the presence of a bico-ordinated Pd complex. ***Pier Giorgio Desideri and Francesco Pantani.*** *Talanta*, v. 8, no. 4, Apr. 1961, p. 235-240.

h

* **Determination of Hydrogen Cyanide by Gas Chromatography.** A rapid, accurate and precise gas chromatographic method for the determination of hydrogen cyanide in mixtures

of the permanent gases and water vapor is described. Results are given for the hydrogen cyanide and nitrogen contents of synthetic gas mixtures of known composition. The effects of various column pretreatments on accuracy and precision are discussed. The apparatus is very suitable for the frequent determination of hydrogen cyanide, nitrogen, oxygen, methane and carbon monoxide in mixtures of these gases. ***K. G. Woolmington.*** *Journal of Applied Chemistry*, v. 11, Mar. 1961, p. 114-120.

i

* **Determination of Molecular Weights in the Ultracentrifuge by the Archibald Procedure.** The procedure is rapid, slight amounts of material are required, and the determination of the weight average of molecular weight and of unknown concentrations is possible. With low molecular weight materials, consisting of two components, the molecular weight and concentration of each single component can be determined. The determination of the distribution of molecular weights seems to be conceivable. The method is applicable to molecular weights ranging from as low as about 100 to as high as some 10^6. (*In German.*) Bestimmung des Molekulargewichts in der Ultrazentrifuge nach dem Archibald-Verfahren. ***H. G. Elias.*** *Angewandte Chemie*, v. 73, no. 6, Mar. 21, 1961, p. 209-215.

j

The Determination of Total Rare Earths in High Grade Uranium Products. A procedure is described for the determination of total rare earth oxides in high grade uranium products, based on the use of solvent extraction with long-chain alkyl amines. Extraction with tri-isooctylamine from strong hydrochloric acid medium removes uranium, zirconium, and a number of other ions. This is followed by a second extraction from sulphate solution, employing di(tridecyl P) amine to remove thorium. Following further conventional purification steps, mixed rare earth oxides are determined by ignition to the oxides, or by a suitable colorimetric method. ***R. J. Guest.*** *Canada, Mines Branch, Research Report*, R-67, Aug. 1960, 22 pp. (TN26 C16.5r Contin.)

k

Recovery of Np-237 by an Oxidation-Reduction Fluoride Precipitation Method. Several hundred grams of Np-237 in nitric acid solution was ~95% recovered as NpO_2 of >99.5% purity. The remaining 5% was recovered as a nitric acid solution of 99.95% purity. The neptunium was oxidized to the soluble +6 state with sodium bromate, and Pu(IV), thorium, and other impurities in the solution were precipitated as fluorides. The neptunium was then reduced to Np(IV) with sulfur dioxide and precipitated as $KNpF_6$, dissolved in nitric acid, precipitated as neptunium oxalate, and calcined to the oxide. The recovered material balance was 99.91% with a process loss of 0.09%. ***R. D. Baybarz.*** *U. S. Atomic Energy Commission, ORNL*-3055, Apr. 4, 1961, 11 pp. (UF767 U3o Contin.)

Gas Chromatography, 1960. Proceedings of the third symposium organized by the Society for Analytical Chemistry and the Gas Chromatography Discussion Group of the Hydrocarbon Research Group of the Institute of Petroleum, held at Edinburgh, June 8-10, 1960. ***R. P. W. Scott, editor.*** 466 pp. 1960. Butterworths, Inc., Washington, D. C. (QD271 Sco85g)

* **Spectrophotometric Investigation of Complex Cobalt Bromides in Alcoholic Solutions.** In $CoBr_2$ + LiBr alcoholic solutions, very complex ions from CoB to $CoBr_6^{--}$ were formed. The lengthwaves of the maxima of absorption were determined. The stability constants of the complexes at 20, 30, and 40° as well as ΔF, ΔH, and TΔS. (*In Russian.*) Spektrofotometricheskoe issledovanie kompleksnykh bromidov kobal'ta v spirtovykh rastvorakh. ***S. A. Shchukarev and O. A. Lobanev.*** *Zhurnal Neorganicheskoĭ Khimii*, v. 6, no. 4, Apr. 1961, p. 804-808.

Gas-Liquid Chromatography in Qualitative Analysis. An Interpolation Method for the Prediction of Retention Data. A logarithmic interpolation method for the prediction of the retention times of unsymmetrical molecules from those of the symmetrical counterparts is described. The classes of organic compounds to which the method has been successfully applied include *n*-paraffins, olefins, sulfides, disulfides, thiols, sec.-alcohols, halides, ketones, ethers and selenides. ***M. B. Evans and J. F. Smith.*** *Journal of Chromatography*, v. 5, no. 4, Apr. 1961, p. 300-307.

* **Utilization of Neutron Activation Analysis for the Determination of Tungsten Content in Minerals and in Co**

centration Products. The method can be used for the determination of tungsten content in steels and metalloceramic hard alloys containing cobalt and titanium. (*In Russian.*) Primenenie neĭtronnogo aktivatsionnogo analiza dlia opredeleniia soderzhaniia vol'frama v mineralakh i produktakh obogashcheniia. ***I. N. Plaksin, I. F. Slepchenko, and L. P. Starchik.*** *Akademiia Nauk SSSR, Doklady,* v. 137, no. 4, 1961, p. 880-881.

* **Radiative Kinetic Method for Determination of Ultra-Small Amounts of Polonium.** (*In Russian.*) Radiatsionno-kineticheskiĭ metod opredeleniia ul'tramalykh kolichestv poloniia. ***V. I. Kuznetsov and E. S. Ufianova.*** *Akademiia Nauk SSSR, Doklady,* v. 137, no. 4, 1961, p. 869-872.

* **New Isotope Ir^{183}.** This work deals with determination of the half-life of Ir^{183}. (*In Russian.*) Novyi izotop Ir^{183}. ***A. K. Lavrukhina, T. V. Malysheva, and B. A. Khotin.*** *Akademiia Nauk SSSR, Doklady,* v. 137, no. 3, Mar. 1961, p. 551-552.

* **Separation and Quantitative Determination. Application to the Quantitative Determination of Arsenic in the Zinc and Lead Industry.** The method described permits the easy performance of a large series of determinations within relatively short time. Arsenic in solution after reacting with the sample is isolated by extraction with a sodium ethyl xanthalate solution in carbon tetrachloride. It is redissolved in water and quantitatively determined by a colorimetric process with Mo blue according to the Zinzadze method. (*In French.*) Séparation et dosage de l'arsenic. Application au dosage de l'arsenic dans l'industrie du zinc et du plomb. ***N. Dreulle.*** *Chimie Analytique,* v. 43, Apr. 1961, p. 165-168.

* **Thermogravimetric Determination of Ethylenediamine and Quinine With Dilituric Acid. Solubilities of Some Polymethylenediamine Diliturates.** The thermolysis curves of ethylenediamine, trimethylenediamine, tetramethylenediamine, pentamethylenediamine, trimethylamine and quinine dilituratesere determined. These curves established that either the hydrated or the anhydrous form of ethylenediamine and quinine dilituratesis stable enough for their gravimetric use to be possible. Both ethylenediamine and quinine were determined by precipitation with alcoholic dilituric acid solution. ***Alexandre Berlin and Rex J. Robinson.*** *Analytica Chimica Acta,* v. 24, no. 4, Apr. 1961, p. 319-328.

* **The Determination of Organo-Phosphorus Insecticides in Vegetables. A General Method for Insecticide Residues.** A method is described for the extraction of insecticides from treated cabbages and other vegetables and for their separation into water-soluble and petroleum-soluble groups. The further separation of members of each group from associated plant material is described for 18 organo-phosphorus insecticides, and the quantitative separation of both groups is discussed, with particular reference to mixtures of phorate with its oxygen-analogue sulphone and parathion-methyl with Phosdrin. ***E. Q. Lawes and D. J. Webley.*** *Analyst,* v. 86, Apr. 1961, p. 249-255.

Analysis of Film-Forming Finishes in Textiles. The analytical system suggested is based very largely on infrared technique. As in the existing tentative test method, selective solvent solubility is used to separate the various materials which may be encountered. Once the materials have been separated, they are checked by infrared spectra, using either unsupported films of the extracts, or potassium bromide pellets prepared by standard methods. These spectra are compared with known spectra, which in many instances are able to pinpoint the type or chemical nature of the particular film former. Micro tests, such as the Liebermann-Storch reaction, are used for confirmatory indications. ***Braham Norwick.*** *American Dyestuff Reporter,* v. 50, no. 9, May 1, 1961, p. 34-40.

* **Chromatography of Organic Substances. VIII. Separations of Aldehydes and Ketones After Condensation With Cyanacethydrazide.** In addition to the method described, the relationships between the amount of energy of the intermolecular hydrogen bridges of the individual products of condensation, and their chromatographic behavior were studied. (*In German.*) Chromatographie organischer Substanzen. VIII. Trennung von Aldehyden und Ketonen nach der Kondensation mit Cyanacethydrazid. ***J. Franc and G. Čelikovská.*** *Collection of Czechoslovak Chemical Communications,* v. 26, no. 3, Mar. 1961, p. 667-672.

* **Microdetermination of Deuterium in Organic Substances.** A new simple and rapid method was developed for the consumption of organic deuterium-containing compounds. Water was directly produced and used without any further purification for the isotope analysis by the drop-falling method. The product of decomposition of silver permanganate was used as oxidation catalyst at 500 C. The product of decomposition of potassium permanganate was used at the same temperature for the quantitative absorption of nitric oxide. (*In German.*) Mikrobestimmung von Deuterium in organischen Substanzen. ***J. Horáček.*** *Collection of Czechoslovak Chemical Communications,* v. 26, no. 3, Mar. 1961, p. 772-780.

Treatise on Analytical Chemistry. Pt. II. Analytical Chemistry of the Elements. Sec. A. Systematic Analytical Chemistry of the Elements. Discusses inorganic nomenclature, general concepts, hydrogen, water, inert gases, and alkali metals. ***I. M. Kolthoff and Philip J. Elving, editors.*** v. I. 471 pp. 1961. Interscience Publishers, New York. (QD75 K83t)

* **Concerning the Production and Splitting of Fluorine Sulfinic Acid Esters.** Fluorine sulfinic acid esters are obtained by fluorination of chlorine sulfinic acid esters with potassium fluorine sulfinate. Their thermal splitting results in the corresponding fluorine compounds and occurs most easily in silver containers in the presence of low amounts of donator compounds, especially tertiary amines, during rapid heating of the fluorine sulfinic acid esters up to the temperature of decomposition. (*In German.*) Über die Darstellung und Spaltung von Fluorsulfinsäureestern. ***Albrecht Zappel.*** *Chemische Berichte,* v. 94, no. 4, 1961, p. 873-880.

* **Applications of Cathode-Ray Polarography in the Field of Oceanography.** Emphasis in this report has been placed on results of a preliminary study of the behavior of chloride ion, some trace elements, and dissolved oxygen in sea water. The advantages of rapidity, specificity, sensitivity, and adaptability to solid electrode systems and direct reading instrumentation for continuously recording these constituents found in sea water have been pointed out. ***Gerald C. Whitnack.*** *Journal of Electroanalytical Chemistry,* v. 2, no. 2, Mar.-Apr. 1961, p. 110-115.

* **Investigation Through Thermal and Radiographic Analysis of the Reaction of Tungsten Trioxide and Carbon Monoxide.** By reduction of WO_3 by CO, first blue β-tungsten oxide ($WO_{2,90}$) and then W are formed at lower temperatures between about 500 and 650 C. The atomic W, together with the atomic C immediately catalytically precipitated, united with the radiographically amorphous WC which crystallizes with slightly more difficulty due to the surrounding C. At 550 C the reduction begins after a very long incubation period with a long induction period. (*In German.*) Über die Thermo- und Röntgenanalytische Untersuchung der Reaktion von Wolframtrioxid und Kohlenoxid. ***A. J. Hegedüs, K. Sasvári, and J. Neugebauer.*** *Acta Chimica Academiae Scientiarum Hungaricae,* v. 26, nos. 1-4, 1961, p. 113-127.

* **The Role of the Polarograph During Activation Analyses.** When radioactive traces of activation substances are examined, the measurements are taken with a polarograph. Tests showed the usability of this method when the presence of heavy metals producing stable amalgams is to be determined. The method is even more advantageous if the duration of the decomposition of the substances is short, but the traces to be examined remain active a long time. (*In French.*) Le rôle du polarographe aux analyses d'activation. ***Z. Ferenczy.*** *Acta Chimica Academiae Scientiarum Hungaricae,* v. 26, nos. 1-4, 1961, p. 229-234.

* **Mass Analytic Determination of Thallium Ions. I. The Formal Redox Potential of the Thallium(III)-Thallium(I) System in the Presence of Bromide Ions. II. Determination in the Presence of Variamine Blue as the Indicator.** (*In German.*) Massanalytische Bestimmung von Thalliumionen. I. Das Formalredoxpotential des Systems Thallium(III)-Thallium(I) in Anwesenheit von Bromidionen. II. Bestimmung in Anwesenheit von Variaminblau als Indikator. ***L. Erdey, K. Vigh, and I. Buzás.*** *Acta Chimica Academiae Scientiarum Hungaricae,* v. 26, nos. 1-4, 1961, p. 85-103.

Chromatographic and Electrophoretic Techniques. Chromatography. Chapters deal with the preparation and interpretation of chromatograms of amino-acids, indoles, sugars,

barbiturates, etc., and, after a description of the solvents and location reagents most useful in each field, there is a full discussion of the clinical significance of various components found in abnormal urine, blood, and other human fluids, as well as applications to plant and animal biochemistry. A simple apparatus for the separation of steroids is described and the significance of the results discussed. ***Ivor Smith, editor.*** v. I. 2nd Ed. 617 pp. 1960. Interscience Publishers, New York. (QD271 Sm59c2)

Chromatographic and Electrophoretic Techniques. Zone Electrophoresis. Each apparatus has been described with all practical details necessary for its operation and with a minimal number of buffers, solvents, location reagents and stains for adequate resolution and location of the various families of interest. Individual chapters deal with each electrophoretic technique which can be considered suitable for routine application. Thus separate chapters deal with paper electrophoresis, cellulose acetate electrophoresis and immuno-diffusion techniques, starch, agar gel and foam rubber electrophoresis, and high voltage electrophoresis; moving boundary methods are excluded as they do not come within our definition of routine. Amongst the more important families discussed are the proteins, lipoproteins, and other serum components, normal and abnormal haemoglobins, amino acids, indoles, and phenolic compounds. ***Ivor Smith, editor.*** v. II. 215 pp. Interscience Publishers, New York. (QD271 Sm59c2)

* **Gas Chromatography Applied to the Analysis of Pyridines and Quinolines.** Pyridines, quinolines, and, less effectively, anilines may each be separated into different groups by gas chromatography on two types of liquid stationary phase, one of low polarity comprising such materials as silicones, paraffins, or esters, the other, polar materials containing hydroxyl or cyano groups. "Silicone E-301" may be used as a nonpolar phase liquid for pyridines, quinolines, and anilines. Diglycerol is a suitable polar liquid for separating pyridines, and, near its upper limit of working temperature, for anilines. Hexa(cyanoethyl)melamine may be used as a polar phase for anilines and quinolines. ***J. S. Fitzgerald.*** *Australian Journal of Applied Science,* v. 12, no. 1, Mar. 1961, p. 51-68.

* **Gas Chromatographic Working Method. I. Possibility to Apply a Flame Ionization Detector.** In addition to the combination of this detector with a capillary column according to Golay, the usual gas chromatographic trace analysis was enlarged by using normal separating towers. With hydrocarbons, the large linearity range of this detector permitted the quantitative measurement of $1:10^6$ concentration differences. With a 20-40μl specimen, impurities of the order of magnitude of 10 ppb (1.10^{-9}) were found. (*In German.*) Gaschromatographische Arbeitsmethoden. I. Die Anwendungsmöglichkeiten eines Flammenionisationsdetektors. ***D. Jentzsch and K. Friedrich.*** *Zeitschrift für Analytische Chemie,* v. 180, no. 2, 1961, p. 96-109.

CHEMISTRY—INORGANIC AND GENERAL

The Condensation of Borazine to Polycyclic Boron-Nitrogen Frameworks by Pyrolytic Dehydrogenation. When $B_3N_3H_6$ vapor is heated at temperatures between 340 and 440° in all-glass cells, it decomposes to give hydrogen a tan-colored, nonvolatile solid of composition approximately $BHN_{0.8}$ and traces of volatile materials. The pyrolysis is kinetically first order with respect to borazine. The $BNH_{0.8}$ slowly loses more hydrogen at 475°, eventually forming a white nonvolatile solid of composition approaching $BNH_{0.3}$. Batch pyrolysis of larger quantities of borazine vapor in a hot-cold apparatus, followed by separation of the products by distillation and sublimation in a vacuum system, has yielded hydrogen and a number of boron-nitrogen containing materials. The mechanism by which borazine decomposes thermally is considered and compared with the pyrolytic behavior of benzene. ***A. W. Laubengayer, P. C. Moews Jr., and Richard F. Porter.*** *American Chemical Society, Journal,* v. 83, Mar. 20, 1961, p. 1337-1342.

* **The Production of Anhydrous Magnesium Chloride by Chlorination Process.** The present study was made for the production of anhydrous magnesium chloride by the direct chlorination of magnesium hydroxide, deposited from sea water, below the melting point of magnesium chloride. (In *Japanese.*) ***Shiro Ino and Yasuo Ochiai.*** *Government Chemical Industrial Research Institute, Tokyo, Reports,* v. 56, Mar. 1961, p. 81-89.

* **Contributions to the Chemistry of the Elements Niobium and Tantalum. XXVI. The Oxychlorides Nb_3O_7Cl, $NbOCl_3$ and $TaOCl_3$.** Nb_3O_7Cl is formed by thermal interaction (600 C) between Nb_2O_5 and $NbOCl_3$ as colourless single crystals or as blue crystals. It is thermally transportable. (*In German.*) Beiträge zur Chemie der Elemente Niob und Tantal. XXVI. Die Oxydchloride Nb_3O_7Cl, $NbOCl_3$ und $TaOCl_3$. ***Harald Schäfer, Engelbert Sibbing, and Rudolf Gerken.*** *Zeitschrift für Anorganische und Allgemeine Chemie,* v. 307, nos. 3-4, Jan. 1961, p. 163-173.

* **Sodium Fluoride Formation in Pressure Leaching of Bauxite.** During this process CaF_2 and the fluoride content of the compound, such as apatite, leads to the formation of NaF; this causes the reaction of CaF_2 with the caustic soda described. When cooling the solution the reverse process is rendered difficult because of the combination of the sodium hydroxide into calcium hydroaluminates. The temperature of the process, the caustic modulus of the aluminate solution and the relationship between CaF_2 and the solution have a definite effect on the NaF yield during the reaction of CaF_2 with the aluminate-alkali solutions. (*In Russian.*) Obrazovanie ftoristogo natriia pri avtoklavnom vyshchelachivanii boksitov. ***M. N. Smirnov.*** *Tsvetnye Metally,* v. 34, no. 3, Mar. 1961, p. 62-68.

A Survey Report on Lithium Hydride. The physical and chemical properties of lithium hydride are described, based on reasonably full coverage of the available unclassified literature as of July 1, 1960. Lithium deuteride and lithium hydride gas are included. Practical matters such as thermal stability, corrosive character, utilization, handling, fabrication, and analysis are discussed. ***Charles E. Messer.*** U. S. *Atomic Energy Commission, NYO*-9470, Oct. 27, 1960, 58 pp. (UF767 U3 Contin.)

* **Electron-Deficient Compounds.** Describes the modern view of the structure and bonding of these compounds, as well as some of their distinctive chemical reactions. ***F. G. A. Stone.*** *Endeavour,* v. 20, no. 78, Apr. 1961, p. 61-67.

* **Equilibrium Diagram of the Indium-Mercury System.** Indium with Hg forms two congruently melting intermetallic compounds $InHg_6$ and InHg, and one incongruently melting intermetallic compound In_7Hg. The melting temperature of $InHg_6$ is −14.4 C, of InHg −18.6 C; the temperature of decomposition of In_7Hg is +65 C. Three eutectics are formed, as well as an α-solid solution (4.3-22.5 at.% In), a β-solid solution (48-51 at.% In), and a γ-solid solution (86.9-10 at.% In). (In *Russian.*) Diagramma sostoianiia sistemy indiĭ-rtut'. ***L. F. Kozin and N. N. Tananaeva.*** *Zhurnal Neorganicheskoĭ Khimii,* v. 6, no. 4, Apr. 1961, p. 909-912.

* **Crystalline Double Salts of Lead Iodide.** New salts based on lead iodide, and on iodides of Li, Na, acetone, K, and ammonium from methanol, acetone, and acetonitrile were synthesized. The composition of these compounds was determined. In their formation, the nature of the solvent plays an important part. (*In Russian.*) Kristallicheskie dvoĭnye soli Iodistogo svintsa. ***A. M. Golub and G. I. Golodets.*** *Ukrainskiĭ Khimicheskiĭ Zhurnal,* v. 27, no. 2, 1961, p. 138-141.

The Reaction Between Phosphorus Trifluoride-Borane and Ammonia. The Synthesis of Triamidophosphorus-Borane, $(NH_2)_3PBH_3$. The reaction of unstable phosphorus trifluoride-borane and ammonia yields the new, unstable compound, $(H_2N)_3PBH_3$. A formal analogy between BH_3 and O is developed, and evidence is presented to indicate that the B-P bond is not broken during the ammonolysis of F_3PBH_3. ***Kodama and R. W. Parry.*** *Journal of Inorganic and Nuclear Chemistry,* v. 17, nos. 1-2, Apr. 1961, p. 125-129.

* **Thermal and Tensiometric Study of the $TaCl_5$-$FeCl_3$-NaCl and $ZrCl_4$-$FeCl_3$-NaCl Systems.** It is possible to separate tantalum chlorides and iron chlorides by distillating them in the presence of sodium chloride. This is not fully possible in the case of $ZrCl_4$ and $FeCl_3$. (*In Russian.*) Termicheskoe i tenzometricheskoe izuchenie sistem $TaCl_5$-$FeCl_3$-NaCl i $ZrCl_4$-$FeCl_3$-NaCl. ***I. S. Morozov and A. T. Simonich.*** *Zhurnal Neorganicheskoĭ Khimii,* v. 6, no. 4, Apr. 1961, p. 937-943.

Niobium Dihydride, NbH_2. Niobium dihydride was prepared in a pure form by cathodic hydrogenation of niobium metal. Its homogeneity range extends from $NbH_{2-\infty}$ to ca. $NbH_{2-0.7}$. It crystallizes with the fluoride structure and has a lattice constant of 4-563Å. Niobium dihydride is unstable and decomposes into β-NbH and hydrogen. (*In German.*) Niobdihydrid, NbH_2. ***G. Brauer and Horst Müller.*** *Journal of Inorganic and Nuclear Chemistry*, v. 17, nos. 1-2, Apr. 1961, p. 102-107.

* **Preparation and Separation of Niobium Trichloride by Means of Preferential Hydrogen Reduction.** ***Toyoji Ishiyama and Tadashi Kuroda.*** *Electrochemical Society of Japan, Journal* (Overseas Ed.) v. 28, nos. 7-9, 1960, p. E125-E126.

Interstitial Compounds of Boron. A model of the structure of boron compounds is presented which explains such compounds as $B_{13}O_2$, B_4C, $B_{12}C_2$, $B_{13}P_2$,$B_{13}As_2$ and B_4Si as a group of interstitial compounds of boron. Formation of a new boron sulfiide, $B_{12}S$, belonging to the same group is reported. ***V. I. Matkovich.*** *American Chemical Society, Journal*, v. 83, Apr. 20, 1961, p. 1804-1806.

* **A Study of the Thermal Decomposition of Simple and Double Seleniates of Cobalt, Potassium, Rubidium and Cesium.** For temperatures increasing regularly from 20 to 1000 C, these seleniates go through several intermediate states and finally result in a mixture of alkaline seleniate and Co oxide. Cobalt seleniate finally results in a CoO and Co_3O_4 mixture. The alkaline seleniates are stable. (*In French.*) Étude de la décomposition thermique des séléniates simples et doubles de cobalt et de potassium, rubidium et césium. ***Colette Malard.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 252, no. 15, Apr. 10, 1961, p. 2238-2240.

Absorption and Photochemistry of AgCl Crystals With Bivalent Cation and Anion Additions. The divalent cations of these crystals produce a change of the optical absorption at −185 C as compared with AgCl crystals with Ag_2S or Ag_2Se doping. Thus as a rule the optical absorption bands shift by 0.50 eV up to 0.15 eV approximately. Photochemically such solid solutions at low temperatures ($T < -150$ C) are almost sensitive. A photochemical coloration is obtained only from about −130 C. These processes were explained. (*In German.*) Absorption und Photochemie von AgCl-Kristallen mit zweiwertigen Kationen- und Anionenzusätzen. ***A. Scholz.*** *Annalen der Physik*, v. 7, nos. 3-4, Jan. 1961, p. 179-188.

* **The Interaction of Boron Trifluoride With Hydrazine.** Boron trifluoride and anhydrous hydrazine react rapidly at 25° *in vacuo* yieldng a 1:1 complex compound, $BF_3 \cdot N_2H_4$ (m.p. 87°), while at higher temperatures, or with diethyl ether as solvent, they form complex mixtures containing 52.2 to 63.5 mole% BF_3; but in tetrahydrofuran solution the 2:1 adduct, $2BF_3 \cdot N_2H_4$ (m.p. 260°) is formed. The thermal decomposition of $BF_3 \cdot N_2H_4$ is complex, yielding in part N_2, NH_3, NH_4BF_4, and BN. Hydrolysis of $BF_3 \cdot N_2H_4$ yields a mixture of hydroxyfluoroborate ions. At −80°, $BF_3 \cdot N_2H_4$ absorbs NH_3 to form a diammoniate which liberates NH_3 slowly at higher temperatures. Partial displacement of BF_3 from $BF_3 \cdot N_2H_4$ by HCl and partial absorption of HCl by $BF_3 \cdot N_2H_4$ occur simultaneously at 110°. ***W. G. Paterson and M. Onyszchuk.*** *Canadian Journal of Chemistry*, v. 39, May 1961, p. 986-994.

* **Reduction With Sodium Hydride Especially From the Point of View of the Fabrication of Silicon and Boric Hydrogen Compounds.** Sodium hydride is very suitable for the reduction of different halogenide elements. The method described allows the replacement of expensive Al and B hydrides such as $LiAlH_4$ and $NaBH_4$ by the inexpensive NaH, especially the activated NaH for the fabrication of different silicon hydrogens (SiH_4 inclusively). On the basis of B halides, (BCl_3), B_2H_6, Al potash B hydrides and BH_3 complexes of different amines as well as B trialkyls, alkyl B hydrogens and alkyl B halides are obtainable by a simple process. (*In German.*) Reduktion mit Natriumhydrid unter besonderer Berücksichtigung der Herstellung von Silicium- und Borwasserstoffverbindungen. ***Herbert Jenkner.*** *Chemiker-Zeitung/Chemische Apparatur*, v. 85, no. 8, Apr. 20, 1961, p. 264-272.

* **Some Studies in Inorganic Complexes. IX. The Pyrolysis of Hexammineosmium(III) Salts. X. Cadmium and Indium With 2-Picolylamine.** A study has been made of the action of heat on the salts $Os(NH_3)_6ISO_4$ and $Os(NH_3)6X_3$, in which X is bromide or iodide. The initial products are $[OsI(NH_3)_5]SO_4$ and $[OsX(NH_3)_5]X_2$ respectively. At higher temperatures the latter decompose into black double-halogen bridged complexes $[(NH_3)_5XOsX_2OsX(NH_3)_5]X_2$, while the sulfate forms a black residue of composition corresponding to $Os(NH_3)_3ISO_4$ but of unknown structure. Further heating results in oxidation to OsO_4 and halogen in all cases. ***G. J. Sutton.*** *Australian Journal of Chemistry*, v. 14, no. 1, Feb. 1961, p. 33-40.

CHEMISTRY—ORGANIC

* **Conversion of 1,1-Dichloro-2-alkylcyclopropanes to Allenes and Cyclopropanes.** The reaction of 1,1-dichloro-2-alkylcyclopropanes with Mg metal and alkyl or aryl halides yields 1,2-alkadienes (allenes) and alkylcyclopropanes as the principal products. This is the first reported preparation of allenes from the dichlorocarbene ($:CCl_2$) adducts of olefins. ***Ted J. Logan.*** *Tetrahedron Letters*, 1961, no. 5, Apr., p. 173-175.

Biochemical Preparations. ***Alton Meister, editor.*** v. VIII. 146 pp. 1961. John Wiley & Sons, New York. (QP509 B52p Vis.)

* **The Alkylation of *o*-Bromanisol by Propylene, Butene-2 and Cyclohexene in the Presence of $BF_3 \cdot H_3PO_4$.** With all the olefins indicated in the study, 4 alkyl 2-bromanisols with a 57 to 77% yield were obtained. The products of alkylation of 4-isopropyl-, 4-fluoro-butyl and 4-cyclohexyl-2-bromanisol are transformed by organo-magnesium synthesis into the corresponding 5-alkyl-2-metoxybenzoic acids. (*In Russian.*) Alkilirovanie *o*-bromanizola propilenom, bytenom-2 i tsiklogeksenom v prisutstvii $BF_3 \cdot H_3PO_4$. ***V. G. Kriuchkova and S. V. Zavgorodnii.*** *Zhurnal Obshcheĭ Khimii*, v. 31(93), no. 3, Mar. 1961, p. 731-733.

* **Investigations in the Field of Amines and Ammonium Compounds. XVI.** New instances of the dehydrochlorination-splitting reaction of halide-alkyl-containing ammonium salts by aqueous alkali were studied. (*In Russian.*) Issledovaniia v oblasti aminov i ammonievykh soedineniĭ. XVI. ***A. T. Babaian and G. T. Martirosian.*** *Zhurnal Obshcheĭ Khimii*, v. 31(93), no. 3, Mar. 1961, p. 825-829.

Aromatic Aldehydes From Benzyl Alcohols *via* Inorganic Hypochlorite Oxidation. Benzaldehyde and *o*-methoxy-benzaldehyde were obtained in good yield from their respective alcohols. Under the conditions employed there was no evidence of reaction between the hypochlorite and these aldehydes. *o*-Hydroxybenzyl alcohol, under identical conditions, provided no aromatic aldehyde but was chlorinated in the nucleus with a concurrent elimination of formaldehyde. Possible mechanisms are considered. ***Cal Y. Meyers.*** *Journal of Organic Chemistry*, v. 26, Apr. 1961, p. 1046-1050.

Cyanocarbon Chemistry. XVIII. Tricyanovinylation of Hydrazones and Other Nucleophilic Substances. The strongly electrophilic nature of tetracyanoethylene is shown by its reaction with the wide range of nucleophilic substances represented by aromatic hydrazones, azulene, pyrrocoline and 2-methylfuran. The condensation that occurs introduces a tricyanovinyl group at one of the positions of high electron density. Tricyanovinyl chloride complements tetracyanoethylene as a tricyanovinylation agent in showing increased reactivity and condensing with sterically hindered compounds. The tricyanovinyl aromatic compounds are new classes of dyes. ***J. R. Roland and B. C. McKusick.*** *American Chemical Society*, Journal v. 83, Apr. 5, 1961, p. 1652-1657.

The Rearrangement of Allyl Ethers to Propenyl Ethers. Several mono- and polyfunctional allyl ethers have been rearranged to the corresponding propenyl ethers by treatment at 150-175° in the presence of a basic catalyst. The rearrangement reaction is stereospecific, yielding 95-100% *cis*-propenyl ether. A catalyst deactivation effect is observed with ultimate degree of rearrangement being a function of initial catalyst concentration but not of temperature. The rearrangement reaction affords a convenient preparative procedure for pro-

penyl ethers. ***T. J. Prosser.*** *American Chemical Society, Journal,* v. 83, Apr. 5, 1961, p. 1701-1704.

The Reaction of Decaborane With Aromatic Amines. Decaborane reacts with *p*-anisidine, *p*-toluidine, *p*-chloroaniline, aniline, N-methylaniline and N,N-dimethylaniline to yield a product possessing the formula $B_{10}H_{12}(\text{amine})_n$, where $n = 2$ or 3. The rates of reaction for these amines vary from 0.02 to 23.8 x 10^{-3} liter $mole^{-1}$ sec. $^{-1}$ at 25.0° in benzene solution. Evidence is presented for the formation of a reaction intermediate. ***Harold C. Beachell and Bruce F. Dietrich.*** *American Chemical Society, Journal,* v. 83, Mar. 20, 1961, p. 1347-1351.

* **Formation of Cyclohexano [*c*] 1,2,5-oxadiazole From 1,2-Cyclohexanedione Dioxime. An Attempted Beckmann Rearrangement With Thionyl Chloride in Liquid Sulfur Dioxide.** The rearrangement of 1,2-cyclohexanedione dioxime with thionyl chloride in liquid sulfur dioxide resulted in the formation of cyclohexano [*c*] 1,2,5-oxadiazole in 70% yield. ***Niichiro Tokura, Ritsuro Tada, and Kunio Yokoyama.*** *Chemical Society of Japan, Bulletin,* v. 34, no. 2, Feb. 1961, p. 270-274.

* **Studies on Unsaturated Carboxylic Compounds. Tautomeric Relations in Pentadic Systems Activated by COOH Group.** Examines the behavior of some 2,5 dienic carboxy-compounds in isomerization conditions. (*In Italian.*) Studi sui composti carbossilici insaturi. Relazioni di tautomeria in sistemi pentadici attivati dal gruppo carbossilico. ***Gian Paolo Chiusoli and Sergio Merzoni.*** *Chimica e l'Industria,* v. 43, Mar. 1961, p. 255-259.

* **Vinylation of Tri-n-Butyltin Hydride.** Tri-n-butyltin hydride added smoothly to acetylene. The product was tri-n-butylvinyltin, obtained in 75-80% yields. The reaction was conducted in benzene in an autoclave under 150-200 p.s.i.g. pressure of acetylene. A relatively mild reaction temperature of 75-80° was sufficient to initiate the reaction. ***Edwin M. Smolin.*** *Tetrahedron Letters,* 1961, no. 4, Mar., p. 143-145.

* **A New Synthesis of Substituted Pyridines. I. Main Features of the Synthesis. II. Some Variants and Special Cases. III. Pyridine From Phenyl-phenacyl-(thio)ethers as Well as From ω-Cyan-acethophenone.** (*In German.*) Eine neue Synthese substituierter Pyridine. I. Grundzüge der Synthese. II. Einige Varianten und Sonderfälle. III. Pyridine aus Phenyl-phenacyl-(thio-)äthern sowie aus ω-Cyan-acetophenon. ***Wilfried Zecher and Fritz Kröhnke.*** *Chemische Berichte,* v. 94, no. 3, 1961, p. 690-712.

* **A New Synthesis of Glycerides.** By reaction of mono- and ditritylethers of different glycerides as well as from glycerine tritritylether with fatty acid chlorides and silver perchlorate in nitromethane uniform triglycerides are produced in satisfactory amounts. (*In German.*) Eine neue Synthese von Glyceriden. ***Hellmut Bredereck, Adolf Wagner, and Dieter Geissel.*** *Chemische Berichte,* v. 94, no. 3, 1961, p. 812-816.

Fats and Oils. Fatty Acids. Their Chemistry, Properties, Production, and Uses. Pt. 1. Discusses nomenclature, isomerism, X-ray diffraction and polymorphism and spectral, liquid state, and solution properties. ***Klare S. Markley, editor.*** 2nd Ed. 714 pp. 1960. Interscience Publishers, New York. (QD305.A2 M34f2)

* **Solubilization of Aromatic Hydrocarbons in Hydrosols of Saturated Fatty Acid Soaps.** The solubilization of benzene, toluene and xylene in 0.1 N solutions of the solidum salts of saturated fatty acid homologs has been investigated. An almost linear decrease in solubilization has been observed with decrease in chain length of the soap radical from sodium stearate to laurate. The solubilization effect of the aromatic hydrocarbons is weaker for the lower molecular homologs from sodium laurate to caprylate. For soap radicals with chain lengths less than seven carbon atoms the solutions possess no solubilizing capacity. The solubilization effect may be used to determine the oleophility of detergents, the hydrophilic-oleophilic balance, the micellar structure and the practical merits of detergents. (*In Russian.*) Soliubilizatsiia aromaticheskikh uglevodorodov v gidrozoliakh myl predel'nykh zhirnykh kislot. ***P. A. Demchenko.*** *Kolloidnyĭ Zhurnal,* v. 23, no. 1, Jan.-Feb. 1961, p. 36-39.

* **Inhibition of Enzymatic Decarboxylation of Amino Acids by DL-Penicillamine, L-Cysteine and DL-Homocysteine.** The inhibition of the reaction is due to the formation of the thiazolidine cycle with penicillamine or cysteine, and of a thiazane cycle with homocysteine through condensation of phosphopyridoxal with the amino acids. Addition of phosphopyridoxal to the system inactivated by homocysteine completely restores the original decarboxylase activity. Synthesis of 2-(3-hydroxy-2-methyl-5-hydroxymethyl-pyridyl-4)-1,3-thiazancarboxylic-4-acid has been described. The biological significance of such type of condensation reactions in metabolism is discussed. (*In Russian.*) Tormozhenie fermentativnogo dekarboksilirovaniia aminokislot DL-penitsillaminom, L-tsisteinom i DL-gomotsisteinom. ***S. R. Mardashev and L. A. Semina.*** *Biokhimiia,* v. 26, no. 1, Jan.-Feb. 1961, p. 31-39.
i DL-gomotsisteinom. ***S. R. Mardashev and L. A. Semina.*** *Biokhimiia,* v. 26, no. 1, Jan.-Feb. 1961, p. 31-39.

Some New Fumaric Acid Derivatives. Preparation of Mixed Fumarates and Thiolfumarates. Several new bis-aryl fumarates were prepared by the Schotten-Baumann method. Attempts to modify the chemical and physical properties of these compounds led to the synthesis of certain new alkyl fumaryl chlorides by a convenient method. This involved the reaction of maleic anhydride with an alcohol, followed by treatment with thionyl chloride. The acid chlorides were used as intermediates in the preparation of a variety of mixed fumarate and thiolfumarate esters, and of some new fumaramates. ***Paul G. Campbell, Gene Sumrell, and Charles H. Schramm.*** *Journal of Organic Chemistry,* v. 26, Mar. 1961, p. 697-700.

Deuterio 1,3-Butadienes Derived by Reductive Dechlorination. 1,3-Butadiene-d_6, 1,3-butadiene-2,3-d_2, 1,3-butadiene-2-d_1 and 1,3-butadiene-1-d_1 were prepared. The method of synthesis involves the reduction of mono-, di- and hexachloro-1,3-butadienes, and 1,4-dichloro-2-butyne with zinc and deuterium oxide. The reduction is catalyzed by cupric chloride as well as by sodium iodide. It was also applied to three dichlorobutenes. Dioxane, as previously reported, is a convenient solvent for the reaction but actually no solvent other than water is required. The use of maleic anhydride and gas phase chromatography (propylene carbonate column) for the analysis of 1,3-butadiene is described. ***David Craig and R. B. Fowler.*** *Journal of Organic Chemistry,* v. 26, Mar. 1961, p. 713-716.

Tertiary Amine Catalysis of the Reaction of Phenyl Isocyanate With Alcohols. Although the rate of reaction of phenyl isocyanate with an alcohol is directly proportional to the triethylamine concentration in di-*n*-butyl ether solution, this proportionality does not hold in toluene. The relative catalytic activities of 23 tertiary amines were determined. These activities varied from 0.075 to 23.9. The steric requirements of the tertiary amine exert an overwhelming influence on the catalytic activity. ***John Burkus.*** *Journal of Organic Chemistry,* v. 26, Mar. 1961, p. 779-782.

Centenary Lecture. Some Naturally Occurring Acetylenic Compounds. Reviews fatty acid, methyl ester, and alcohol derivatives. ***N. A. Sörensen.*** *Chemical Society, Journal,* 1961, Mar., p. 98-110.

The Role of Acetate and Malonate in the Biosynthesis of Penicillic Acid. ***Ronald Bentley and John G. Keil.*** *Chemical Society, Journal,* 1961, Mar., p. 111-112.

* **Effects of the Structure-Group Composition of Hydrocarbon Oils on the Yield and Properties of Carbon Black.** The new index proposed for the evaluation of the raw material used for the production of carbon black is called factor of aromatization. This factor definitely characterizes the effect of the composition of the petroleum and coal-tar raw material on the yield and properties of carbon black. When this factor increases, yield, specific surface and oil number of carbon black increase also. (*In Russian.*) Vliianie strukturno-gruppovogo sostava uglevodorodnykh masel na vykhod i svoĭstva sazhi. ***V. P. Zuev, L. P. Giliazetdinov, and P. A. Tesner.*** *Kauchuk i Rezina,* v. 20, no. 2, Feb. 1961, p. 29-32.

Glycidyl Esters. II. Synthesis of Esters of Commercial and Pure Fatty Acids. The reaction of salts of carboxylic acids with epichlorohydrin in the presence of quaternary ammonium halides to form glycidyl esters has been demonstrated

to be applicable to a variety of acids derived from fats, including commercial mixtures. The glycidyl esters of pelargonic, lauric, oleic, dimerized linoleic, ricinoleic, behenic, and sebacic acids as well as those of the fatty acids derived from tallow, wool wax, and soya oil have been prepared in 80-95% yields and purities. ***Gerhard Maerker, Edward J. Saggese, and William S. Port.*** *American Oil Chemists' Society, Journal*, v. 38, Apr. 1961, p. 194-197.

a

* **α-Acetylene Aldehydes Containing Another Function at the End of the Chain.** Several aldehydes having the following formula $X(CH_2)_\alpha{\equiv}CCHO$ (X = -Cl, -C≡CH or $-CO_2C_2H_5$) were obtained by the action of ethyl orthoformiate on the corresponding true acetylene compounds followed by hydrolysis. Some reactions are mentioned. (*In French.*) Sur les aldéhydes α-acétyléniques contenant une autre fonction au bout de la chaine. ***Roland Epsztein, Serge Holand, and Israël Marszak.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 252, no. 12, Mar. 20, 1961, p. 1803-1805.

b

* **Flow Characteristics of Linear, End-Blocked Dimethylpolysiloxane Fluids.** The shear stability, inertness, and flow characteristics of dimethyl silicone fluids make them ideally suited for use in fluid couplings, torsional vibrational dampers, dash pot dampers, shock absorbers, and power boosters. The flow properties of silicone fluids from room temperature to 200 C and at shear rates to 750,000 sec^{-1} are presented. ***Gordon C. Johnson.*** *Journal of Chemical and Engineering Data*, v. 6, no. 2, Apr. 1961, p. 275-278.

c

Ternary Copper dl-Tartrates Formed in Acid Medium. These tartrates were obtained from an acid solution (pH~4) containing divalent Cu, dl-tartrate of Na (or Li) and trivalent complex cations of Co and Cr. Under similar conditions mesotartrate does not yield any ternary salts. (*In Russian.*) Troĭnye dl-tartraty medi obrazuiushchiesia v kisloĭ srede. ***A. V. Ablov and G. A. Popovich.*** *Zhurnal Neorganicheskoĭ Khimii*, v. 6, no. 4, Apr. 1961, p. 846-850.

d

* **Compounds of Addition of Aromatic Amines to Cadmium Halides.** Products of addition of aniline and its monoderivatives in the benzene nucleus were obtained, that is o- and p-toluidine, o- and p-anisidine, o-phenatidine, o-, m-, and p-chloraniline, o-, m-, and p-bromaniline and p-iodaniline to cadmium chloride and cadmium iodide. All the products of addition to cadmium iodide have the following composition: $CdI_2 \cdot 2H_2NC_6H_4X$. Cadmium bromide gives the products of composition $CdBr_2 \cdot 2H_2NC_6H_4X$. (*In Russian.*) Produkty prisoedineniia aromaticheskikh aminov k galogenidam kadmiia. ***A. V. Ablov and V. Ia. Ivanova.*** *Zhurnal Neorganicheskoĭ Khimii*, v. 6, no. 4, Apr. 1961, p. 883-889.

e

* **Investigation of the Reaction of Rare Earth Elements With Alizarin S in the Presence of Ammonia and Amines.** The reactions of alizarin S with Y, La and Ce in the presence of ammonia, ethyldiamine, diethylamine, pyramidone, antipyrine and pyridine were examined and the relationships of these colored compounds with their organic solvents and masking substances, sodium oxalate, and potassium floride were determined. (*In Russian.*) Issledovanie reaktsiĭ redkozemel'nykh elementov s alizarinom S v prisutstvii ammiaka i aminov. ***L. S. Serdiuk and G. P. Fedorova.*** *Ukrainskĭ Khimicheskĭ Zhurnal*, v. 27, no. 2, 1961, p. 252-256.

f

* **The Action of Co^{60} Gamma Radiation on Esters of Phosphoric Acid.** The action of γ-rays from a Co^{60} source on liquid tributyl, tripropyl and triethyl phosphates has been investigated. With the aid of paper chromatography it has been shown that on irradiation of trialkyl phosphates various phosphorus containing products are formed, among which the principal are the corresponding di- and monoalkylphosphoric acids. The accumulation of di- and monoalkylphosphoric acids has been investigated and their radiochemical yields have been determined. (*In Russian.*) O deĭstvii γ-izlucheniia Co^{60} na epiry fosfornoi kisloty. ***V. P. Shvedov and S. P. Rosianov.*** *Zhurnal Fizicheskoĭ Khimii*, v. 35, no. 3, Mar. 1961, p. 569-573.

g

* **Absorption of Amines on Cation Exchange Resins.** All the amines studied are absorbed in excess of the exchange capacity by sulfonated polystyrene resins from aqueous solutions; the absorption is greatest with benzylamine, whose molecular structure is the closest to that of the monomer of the resin. The absorption is greater, the less the crosslinking of the resin, and it is influenced by the electrostatic field of the resin cations. There is no excess absorption from solvents such as alcohols, acetic acid or dioxane. ***S. R. Watkins and H. F. Walton.*** *Analytica Chimica Acta*, v. 24, no. 4, Apr. 1961, p. 334-342.

h

The Effect of Polar Substituents on the Alkali-Catalyzed Hydrolysis of Triorganosilanes. The second-order rate constants for the alkali-catalyzed hydrolysis of 24 ω-cyanoalkyl-, ω-phenylalkyl, fluoroalkyl- and *n*-alkylsilanes have been determined using potassium hydroxide in 93.7 wt.% ethanol at 0°. ***Omar W. Steward and Ogden R. Pierce.*** *American Chemical Society, Journal*, v. 83, Apr. 20, 1961, p. 1916-1921.

i

* **Catalytic Alkylation of Tetralin. IV. Determination of the Alkyltetralin Structure by the Method of Infrared Spectroscopy.** (*In Russian.*) Katalicheskoe alkilirovanie tetralina. IV. Opredelenie stroeniia alkiltetralinov metodom infrakrasnoi spectroscopii. ***N. I. Shuikin, V. A. Shliapochnikov, N. A. Pozdniak, and B. L. Lebedev.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk*, 1961, no. 3, Mar., p. 466-468.

j

* **Preparation and Nitration of Phenyl Cellulose.** The product obtained contains 2 ONO_2 groups according to a glucose pattern, and 2 NO_2 groups next to a phenyl nucleus, a chemically stable compound whose fibrous structure has almost completely disappeared, is soluble in the same solvents as nitrocellulose and exhibits a close affinity to nitroglycerol. (*In French.*) Préparation et nitration de la phénylcellulose. ***Pierre Lhoste and Michel Aubouy.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 252, no. 17, Apr. 24, 1961, p. 2555-2556.

k

Pyrrolidines. I. 1-Substituted 3-Pyrrolidinylmethyl Alcohols and Chlorides. II. 1-Substituted 3-Pyrrolidinylmethyl Esters of Disubstituted Acetic and Glycolic Acids. III. 10-(1-Substituted 3-Pyrrolidinylmethyl)phenothiazines. IV. The Investigation of the Synthesis of 1-Methyl-2-pyrrolidineethanol. I. and III. ***Yao-Hua Wu and R. F. Feldkamp.*** II. ***Yao-Hua Wu, R. F. Feldkamp, John R. Corrigan, and Harold J. Rhodes.*** IV. ***Yao-Hua Wu, John R. Corrigan, and R. F. Feldkamp.*** *Journal of Organic Chemistry*, v. 26, May 1961, p. 1519-1533.

* **Imidoesters. VII. Trichloroacetonitrile, a Reagent for the Selective Esterification of Phosphoric Acids.** The imidoylphosphates II produced intermediately from trichloroacetonitrile and monoesterphosphate or orthophosphate are phosphorylating reagents. Speed of reaction and phosphorylation degree depend on the strength of the added base, hence the possibility to obtain monesters or diesters optionally during the esterification of orthophosphate acid. With the new reaction new nucleotide-derivatives can be produced. (*In German.*) Imidoester. VII. Trichloracetonitril, ein Reagenz sur selektiven Veresterung von Phosphorsäuren. ***Friedrich Cramer and Günter Weimann.*** *Chemische Berichte*, v. 94, no. 4, 1961, p. 996-1007.

* **Concerning Selenazoles. I. Synthesis of Selenazolyl-(2)-hydrazones and Selenazolyl-(2)-hydrazines.** By condensation of selenosemicarbazones with α-haloketocompounds, selenazolyl-(2)-hydrazones were obtained. Through acid hydrolysis of the acetone-selenazolyl-(2)-hydrazones it was possible to isolate the selenazolyl-(2)-hydrazines whose structure was proved by a series of reactions. (*In German.*) Über Selenazole. I. Synthese von Selenazolyl-(2)-hydrazonen und Selenazolyl-(2)-hydrazinen. ***Ehrenfried Bulka, Hans-Georg Patzwaldt, Friedrich-Karl Peper, and Hans Beyer.*** *Chemische Berichte*, v. 94, no. 4, 1961, p. 1127-1137.

Preparation of Some Condensed Ring Carbazole Derivatives. Two new indolocarbazoles have been prepared by vapor phase cyclodehydrogenation of *N,N'*-diphenylphenylenediamines over a platinum-on-magnesia catalyst. This method has also been used for the preparation of benzocarbazoles from phenylnaphthylamines. ***Henry M. Grotta, Charles J. Riggle, and Arthur E. Bearse.*** *Journal of Organic Chemistry*, v. 26, May 1961, p. 1509-1511.

* **Splitting of Ammonium Salts Containing Unsaturated Radicals.** Comparative ease of splitting off different β,γ-unsaturated radicals was studied on the series of quaternary ammonium salts subjected to alkaline as well as thermal treatment,

(*In Russian.*) Rasshcheplenie ammonievykh soleĭ, soderzhashchikh napredel'nye radikaly. ***A. T. Babaian and G. T. Martirosian.*** *Akademiia Nauk Armianskoĭ SSR, Doklady*, v. 32, no. 2, 1961, p. 87-94.

*** Ortho-Substituted Chlorobenzenes Related to Metameconine.** Chlorinated derivatives of metameconine were formed for the first time. Partial demethylation of the derivatives with sulfuric acid occurred in highly selective fashion at the methoxyl ortho to the halogen, without regard to the relative position of the carbonyl group which is known to be highly directive for demethylations in the absence of halogen. The phenolic products of the demethylations are needed for the synthesis of sterically hindered diphenyl ethers. They showed a type of intermolecular hydrogen bonding in the crystal which was markedly subject to steric interference by the halogen atoms. ***J. A. McRae, Marjorie Allen, and R. Y. Moir.*** *Canadian Journal of Chemistry*, v. 39, May 1961, p. 995-1004.

*** Phenyl*iso*cyanate Derivatives of Carbohydrates.** An investigation was made of a method of locating the acetyl groups in partially acetylated carbohydrates using phenyl*iso*cyanate for introducing protective substituents. It was found that the derived phenylcarbamoyl groups sometimes undergo acyl migration but that generally the reagent is suitable for use in the determination of the substituent distribution in partially acetylated 1→4-linked xylans and glucans. ***Hans O. Bouveng.*** *Acta Chemica Scandinavica*, v. 15, no. 1, 1961, p. 87-95.

*** Chemistry of Acetylenic Ethers. XLIX. Vinylthioethyne and Some of Its Derivatives. L. Di(alk-1-ynyl)sulphides. LI. Introduction of Alkylthio Groups Into Acetylenic Compounds and Into Other Compounds With Reactive Hydrogen Atoms by Means of Disulphides.** XLIX-L. ***L. Brandsma and J. F. Arens.*** LI. ***J. R. Nooi and J. F. Arens.*** *Recueil des Travaux Chimiques des Pays-Bas*, v. 80, Mar. 1961, p. 237-256.

*** Dissociation Constants of Bases in Anhydrous Acetic Acid.** From the electrical conductivity, the dissociation constants of pyridine and dimethylaniline, sodium acetate, and potassium acetate were determined. The constants of dissociation of 50 bases in acetic acid were calculated on the basis of the constants of dissociation of pyridine according to the data of Hall concerning the acidity of the bases. (*In Russian.*) Konstanty dissotsiatsiĭ osnovaniĭ v bezvodnoĭ uksusnoĭ kislote. ***A. M. Shkodin, N. A. Izmailov, and L. I. Karkuzaki.*** *Ukrainskĭĭ Khimicheskĭĭ Zhurnal*, v. 27, no. 2, 1961, p. 155-160.

New Addition Reactions. I. Reaction of Epoxides With Ketene. By the addition reaction of 1,2-epoxides with ketene, using boron trifluoride as catalyst, some γ-substituted γ-butyrolactones have been obtained in about 10% yield based on epoxide. ***Ryohei Oda, Sunao Muneimiya, and Masaya Okano.*** *Journal of Organic Chemistry*, v. 26, May 1961, p. 1341-1343.

CHEMISTRY—PHYSICAL (ORGANIC AND INORGANIC)

Thermodynamic Properties of Thorium Dioxide From 298 to 1,200°K. Values were accurately measured at ten temperatures from 323 to 1173 K. ***Andrew C. Victor and Thomas B. Douglas.*** U. S. *National Bureau of Standards, Journal of Research, Section A, Physics and Chemistry*, v. 65A, no. 2, Mar.-Apr. 1961, p. 105-111.

The Photolysis of Ethyl Vinyl Ether. Above was studied with and without mercury photosensitization. ***E. Murad.*** *American Chemical Society, Journal*, v. 83, Mar. 20, 1961, p. 1327-1330.

*** Kinetics of the Dissolving Process of Arsenic in Alkali Solution.** When studying the rate of dissolving in aqueous NaOH solution of synthesized AsSe, $AsSe_{1.5}$, $AsSe_{2.33}$, $AsSe_4$ and $AsSe_9$ in the vitreous state, it was found that the solution of atomic-covalent bonded vitreous $AsSe_{1.5}$ and $AsSe_{2.33}$ occurs with the speed of the heterogeneous chemical reaction with energies of activation of 18 and 21 kilocal/mol respectively. During the solution of vitreous $AeSe_4$ and $AsSe_9$, these are passivated as a result of the accumulation of Se specimens on their surface. The results show the chemical microinhomogeneity of $AsSe_4$($AsSe_{2.5}$·1.4 Se) and $AsSe_9$ glasses and the presence in them of associated Se groups $(\text{-Se-Se})_n$. (*In Russian.*) Kinetika rastvoreniia selenida mysh'iaka v shchelochnom rastvore. ***R. L. Miuller, Z. U. Borisova, and H. I. Grebenshchikova.*** *Zhurnal Prikladnoĭ Khimii*, v. 34, no. 3, Mar. 1961, p. 533-537.

The Radiochemistry of Mercury. Presents up-to-date compilations of radiochemical information and procedures. ***J. Roesmer and P. Kruger.*** 50 pp. Dec. 1960. National Research Council, Washington, D. C. (QD601 N21.6me)

The Radiochemistry of Copper. Deals with the radiochemistry of Cu as one of a series of monographs on radiochemistry of the elements. There is included a review of the nuclear and chemical features of particular interest to the radiochemist. ***F. F. Dyer and G. W. Leddicotte.*** 54 pp. Apr. 1961. National Research Council, Washington, D. C. (QD601 N21.6co)

*** Effects of Lead and Manganese Naphthenate Additions on the Explosive Properties of Some Hydrocarbons.** These naphthenates have a positive effect on the motor properties of some methane hydrocarbons and phenyl acetylenes. Manganese naphthenate is more active despite its lower manganese oxide content. Naphthenates were most active with 2.3 dimethyl pentane, which might be explained by the lowest difference in the temperatures of the starting structural decomposition of the given hydrocarbon and additions. (*In Russian.*) Vliianie dobavok naftenatov svintsa i margantsa na detonatsionnye svoĭstva nekotorykh uglevodorodov. ***B. G. Gavrilov and V. A. Zavertkin.*** *Zhurnal Prikladnoĭ Khimii*, v. 34, no. 3, Mar. 1961, p. 589-592.

*** X-Ray Investigation of Sodium Tellurite Pentahydrate $Na_2TeO_3 \cdot 5H_2O$.** When investigating the Na_2TeO_3-C_2H_5OH-H_2O system, it was found that the sodium tellurite pentahydrate, depending on the condition, crystallizes either in the form of long prisms, or of hexagonal plates. When salting out with ethyl alcohol alkali solutions containing TeO_2, as a rule, a mixture of crystals of the two modifications is formed, with predominance of flat hexagonal plates. During a prolonged (5-7 days) retention of the deposit under a saturated solution of sodium tellurite, all the hexagones are transformed into prisms. The intensity of the chemical composition of the two modifications of sodium tellurite pentahydrate was shown by chemical analysis. (*In Russian.*) Rentgenograficheskoe issledovanie pentagidrata tellurita natriia $Na_2TeO_3 \cdot 5H_2O$. ***K. N. Semenenko and E. A. Lavut.*** *Moscow, Universitet, Vestnik, Seriia II, Khimiia*, no. 6, Nov.-Dec. 1960, p. 27-29.

*** Physico-Chemical Investigation of the Behavior of the Benzol Ring in Connection With the Polarizing Effects of the Medium (of a Solvent or of a Field of Force). I. Magneto-Optical Investigation of the Intramolecular Interactions in Binary System of Nitrobenzol and Alkylderivatives of Benzol.** (*In German.*) Physikalisch-chemische Untersuchungen über das Verhalten des Benzolringes gegenüber der polarisierenden Wirkung eines Mediums (eines Lösungsmittels oder Kraftfeldes). I. Magneto-optische Untersuchung der zwischenmolekularen Wechselwirkungen in binären Systemen von Nitrobenzol und Alkylderivaten des Benzols. ***F. F. Tscheschko, et al.*** *Zeitschrift für Physikalische Chemie* (Leipzig), v. 215, nos. 5-6, 1960, p. 293-307.

The Dependence of Ionic Mobility on the Dielectric Constant of the Solvent. The conductance of tetrabutylammonium and of tetramethylammonium nitrates in acetonitrile-carbon tetrachloride mixtures was measured over the range $11 < D < 36$ at 25°. ***Donald S. Berns and Raymond M. Fuoss.*** *American Chemical Society, Journal*, v. 83, Mar. 20, 1961, p. 1321-1323.

Kinetics of Hydrolysis of *cis*-Difluoro-bis-(ethylenediamine)-chromium(III) Cation. The rates of release of fluoride by acid and base hydrolysis of *cis*-$[Cr(en)_2F_2]^+$ were determined over a range of pH 1-8. ***Klaus R. A. Fehrmann and Clifford S. Garner.*** *American Chemical Society, Journal*, v. 83, Mar. 20, 1961, p. 1276-1279.

Heats of Hydrolysis and Formation of Potassium Borohydride. Heat of reaction with 0.060 molal HCl has been measured by solution calorimetry. The heat of solution of the

hydrolysis products has also been measured and combined with certain literature values to calculate the process. ***Walter H. Johnson, Richard H. Schumm, Isa H. Wilson, and Edward J. Prosen.*** *U. S. National Bureau of Standards, Journal of Research, Section A, Physics and Chemistry*, v. 65A, no. 2, Mar.-Apr. 1961, p. 97-99.

* **The Thermodynamic Properties of Propylene Oxide. *J. H. S. Green.*** *Chemistry & Industry*, 1961, no. 12, Mar. 25, p. 369-370.

The Addition of Silicon Hydrides to Olefinic Double Bonds. VI. Addition to Branched Olefins. The process was studied with each of the methylbutenes, 1- and 4-methylcyclohexene and methylenecyclohexane. ***John Saam and John Speier.*** *American Chemical Society, Journal*, v. 83, Mar. 20, 1961, p. 1351-1355.

* **Solubility of Hydrogen, Nitrogen and Methane in Methanol Under Pressure at Low Temperatures.** Pressure up to 80 at. and temperature between 0 and −60 C were applied. The solubility is well expressed by the equations concerning the diluted solutions of the nonelectrolytes. The solubility of H decreases with the decrease in temperature, and the temperature coefficient of the solubility of N changes its sign at a temperature near 10 C. (*In Russian.*) Rastvorimost' vodoroda azota i metana v metanole pod davleniem pri nizkikh temperaturakh. ***E. R. Shendereĭ, Ia. D. Zel'venskiĭ, and F. P. Ivanovskiĭ.*** *Gazovaia Promyshlennost'*, v. 6, no. 3, 1961, p. 42-45.

* **Silicon-Boron-Tungsten Catalyst for the Hydration of Ethylene.** The new catalyst described possesses high activity at low temperatures and pressures. The optimum working conditions are 230 C, 20-25 at., and 5000-6000 hours^{-1} volumetric speed. Under these conditions the average productivity is 540 g ethanol with 1.1 of catalyst in one hour with 4.2% ethylene transformation. With ethyl alcohol, ester is obtained in amounts comparable to that of the alcohol formed. (*In Russian.*) Kremneborovol'framovyi katalizator dlia gidratatsii etilena. ***G. K. Boreskov, V. A. Dzis'ko, E. M. Piskunova, and T. M. Iur'eva.*** *Khimicheskaia Promyshlennost'*, 1961, no. 2, Feb., p. 23-27.

Ionic Conductivity of Thallium Chloride. Conductivity is compared to earlier work, and several reasons are advanced for considering it to be predominantly ionic. ***R. J. Friauf.*** *Physics and Chemistry of Solids*, v. 18, nos. 2-3, Feb. 1961, p. 203-206.

Optical Rotatory Dispersion of Dyes Bound to Macromolecules. Cationic Dyes: Polyglutamic Acid Complexes. The dyes used were Acidine Orange, pseudoisocyanine and a substituted toluidine-thiazole dye, [*p*-(5-acetyl-4-methyl-2-thiazolylazo)-N-β-aminoethyl-N-ethyl-*m*-toluidine]. Each of these dyes forms a complex with polyglutamic acid over the *p*H range 4.2 to 6.5. ***Lubert Stryer and E. R. Blout.*** *American Chemical Society, Journal*, v. 83, Mar. 20, 1961, p. 1411-1418.

The Thermochemistry of Reductions Caused by Lithium Aluminium Hydride. I. The C—I Bond Dissociation Energy in CH_3I. *A. S. Carson, W. Carter, and J. B. Pedley.* *Royal Society, Proceedings*, v. 260, ser. A, Mar. 21, 1961, p. 550-557.

* **Mechanism of the Interaction of Platinum With Oxygen in Temperatures up to 300°C.** The products of the reciprocal action of Pt with O at low temperatures are different Pt peroxides. Even on a pure Pt surface there is chemosorption of O without any rupture of the molecule into atoms. During the formation of the peroxide film, important changes occur in the structure of the surface of the metal itself, reflected in the frequency and in the change of orientation of its crystals. (*In Russian.*) O mekhanizme vzaimodeĭstviia platiny s kislorodom pri temperaturakh do 300°. ***U. A. Asanov and N. A. Shishakov.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk*, 1961, no. 2, Feb., p. 225-229 + 1 plate.

* **The X-Ray Structure of 2.5-Di-(*p*-iodine benzal-)cyclopentanone.** The substance crystallizes in the rhombic C_{2v}^{15}-Abm2 space group with the lattice constant $a_1 = 7.269$ Å; $a_2 = 38.398$ Å; $a_3 = 6.038$ Å. The density $p = 2.017$ gcm -3. The elementary cell contains four formula units. The molecule whose coordinates were borrowed from several times refined

Fourier projections, crystallizes in the trans-trans arrangement. (*In German.*) Röntgenstrukturuntersuchung von 2,5-Di-(*p*-jodbenzal-)cyclopentanon. ***D. Mootz and K. Plieth.*** *Zeitschrift für Elektrochemie; Berichte der Bunsengesellschaft für Physikalische Chemie*, v. 65, no. 2, Mar. 1961, p. 151-155.

* **The Fusibility of the $PbCl_2$-NaCl System.** Thermal analysis was used in studying this system. The eutectic diagram of fusibility showed the presence of polymorphism in lead chloride. On the basis of the liquidus curve of sodium chloride, it was concluded that the NaCl-2$PbCl_2$ compound is formed in the system. (*In Russian.*) Plavkost' sistemy $PbCl_2$-NaCl. ***T. N. Sumarokova and T. P. Modestova.*** *Zhurnal Neorganicheskoĭ Khimii*, v. 6, no. 3, Mar. 1961, p. 679-681.

Advances in Chemical Physics. Contains papers by leading physical chemists on such subjects as, "Mechanisms of Organic Electrode Reactions", "Propagation of Flames and Detonations", "Electron Diffraction in Gases and Molecular Structure", and others. ***I. Prigogine, editor.*** v. III. 372 pp. 1961. Interscience Publishers, New York. (QD453 Ad95 Vis.)

* **Vapor Pressure of Deuterodiborane. *J. F. Ditter, J. C. Perrine, and Isadore Shapiro.*** *Journal of Chemical and Engineering Data*, v. 6, no. 2, Apr. 1961, p. 271.

* **A New Way of Access to Pyridylalcynes.** Due to reactions bearing on the lateral chains of pyridines bases (C_5H_4N)-$(CH_2)_n$-R, it was possible to prepare oxide ethers (R = OC_2H_5) derivatives containing Br (R = Br) and pyridylalcynes (R = -C≡CH) belonging to the three isomer pyridine series. The acetylene bases were transformed into ketones and Mannich bases. (*In French.*) Sur une nouvelle voie d'accès aux pyridylalcynes. ***Marcel Miocque and Jean-Albert Gautier.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 252, no. 16, Apr. 17, 1961, p. 2416-2418.

* **The Proton Magnetic Resonance Spectrum and Structure of Himgravine.** Spectra of himgravine and himbacine have been obtained in $CHCl_3$ solution at 60 Mc/s. ***R. J. Abraham and H. J. Bernstein.*** *Australian Journal of Chemistry*, v. 14, no. 1, Feb. 1961, p. 64-68.

* **Spectroscopic Study of the Effect of Silicon Atom on Multiple Bondings in the Molecules of Silicon Organic Compounds.** Raman and ultraviolet absorption spectra were obtained for some silicon containing paradi-substituted benzene compounds. In certain systems a specific mutual effect of multiple bonding or aromatic ring and complex electronic shell of the silicon atom was observed. (*In Russian.*) Spektroskopicheskoe issledovanie vliianiia atoma kremniia na kratnye sbiazi v molekulakh kremneorganicheskikh soedinenii. ***Iu. P. Egorov, L. A. Leites, N. G. Tolstikova, and E. A. Chernyshev.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk*, 1961, no. 3, Mar., p. 445-454.

* **A Correlation Between Viscosity and Surface Tension in Liquids.** The surface tension of most liquids can be calculated with sufficient accuracy, exceeding that of the Buehler method, from the viscosity if C = 2.9 is maintained and on the basis of the assumption of the additiveness of the constant m. The atomic increments for the most important nonmetals were given. (*In Hungarian.*) Összefüggés folyakékok viszkozitása és felületi feszültsége között. ***Péter Móritz.*** *Magyar Kémiai Folyóirat*, v. 67, no. 4, Apr. 1961, p. 169-171.

* **Physical and Chemical Investigation of Ternary Aqueous Electrolytic Solutions. VI. Investigating the Conductivity of the LiCl-HCl-H_2O System.** The conductivity of this system was studied at 25 C within the stable entire saturated and unsaturated solution range. Adding HCl to diluted LiCl solutions increases the specific conductivity of the solutions considerably. This increase is lowered by the increase in LiCl concentration beyond 10 mol/l LiCl and addition of HCl has no longer any real effect. If LiCl is added to HCl solutions below 0.9 mol/l concentration, the conductivity increases. If the concentration is higher, the conductivity decreases. The amount of the decrease augments with the initial concentration of the HCl-H_2O system. (*In Hungarian.*) Háromkomponensű vizes elektrolitoldatok fizikai-kémiai vizsgálata. VI. A LiCl-HCl-H_2O rendszer vezetőképességének tanulmányozása. ***Endre Berecz and György Horányi.*** *Magyar Kémiai Folyóirat*, v. 67, no. 4, Apr. 1961, p. 157-162.

Thermodynamics. Comprises a complete, yet precise, and easily understood, presentation of the three basic laws of thermodynamics and their application to chemical problems. The primary presentation of macroscopic thermodynamics is supplemented by statistical considerations of certain topics which help the student to understand why things behave as they do. Statistical methods for calculating thermodynamic properties are also included. Finally, the book gives detailed examples of the thermodynamic properties of important types of systems and concise tables of the thermodynamic properties of the elements and many important compounds. Statistical mechanical derivations are given in detail for the thermodynamic functions of gases and for important topics in solution theory. ***Gilbert Newton Lewis and Merle Randall.*** 2nd Ed. 723 pp. 1961. McGraw-Hill, New York. (QD501 L58t2)

* **Concerning Hydrogen Bridges. IV. Acidity and Hydrogen Bridges in Hydroxy-Biphenyls and Hydroxy-Biphenyl Quinones.** 2.2-Dihydro-biphenyls show a very high acidity in the first stage of dissociation, and a large difference in the second stage if in the mono anion a stable H bridge can be formed. If this bridge is prevented to form by substituents in the 6.6′-position, the hydroxy groups dissociate practically independently from one another. The dissociation of hydroxy-biphenyl quinones was investigated spectroscopically and by potentiometrical titration. (*In German.*) Über Wasserstoffbrücken. IV. Acidität und Wasserstoffbrücken bei Hydroxybiphenylen und Hydroxy-biphenylchinonen. ***Hans Musso and Hans-Georg Matthies.*** *Chemische Berichte,* v. 94, no. 2, 1961, p. 356-368.

COATINGS

The Adhesion of Sprayed Molybdenum. Study of the interfaces between sprayed Mo and mild steel, Co and Brightray bases. The X-ray scanning microanalyzer indicated that the layer between the Mo deposit and the steel base was probably an alloy of Mo and Fe. ***R. T. Allsop, T. J. Pitt, and J. V. Hardy.*** *Metallurgia,* v. 63, Mar. 1961, p. 125-131.

* **Silicones for Maintenance Finishes.** Emphasizes the continued active need for a still larger volume of maintenance coatings. Formulas are included. ***Harold L. Cahn.*** *Paint Industry Magazine,* v. 76, Apr. 1961, p. 8 + 4 pages.

* **Evaporation Rates of Solvents—An Extension of Earlier Studies.** Describes an improved method for the determination of evaporation rates of solvents as the ratio of the time required for evaporation of unit volume of solvent to the time required for evaporation of an equal volume of ether. Includes tables. ***Lynn D. Wilson.*** *Paint Industry Magazine,* v. 76, Apr. 1961, p. 15-17.

* **Synthetic Organic Pigments in Architectural Latex Paints.** Review covers organic pigments both as pigments and as ingredients which can affect or be affected by the other components of a latex paint. ***S. Braverman and M. M. Gerson.*** *Paint Industry Magazine,* v. 76, Apr. 1961, p. 18-20.

* **The Course of the Process of Volatilization of Solvents from Cold Hardened Epoxy Coatings.** The hardness of epoxy amine coatings (hardened at ambient temperature) has been examined in relation to the thickness and seasoning time of these coatings. The relation was established between the hardness of the coatings and their solvent content. (*In Polish.*) Przebieg procesu ulatniania sie rozpuszczalników z powłok epoksydowych utwardzalnych na zimno. ***Michał Taniewski and Ludwika Bulczyńska.*** *Przemysł Chemiczny,* v. 40, no. 3, Mar. 1961, p. 166-169.

Effect of Pickling Factors on 1-Coat Direct Porcelain Enameling. Covers effects of surface concentrations of residual elements from the steel, pickle accelerators and citric acid pickling. *Ceramic Industry,* v. 76, Apr. 1961, p. 102 + 7 pages.

* **Siliciding of Molybdenum Wire and Strip.** Principles of siliciding Mo in vapors of $SiCl_4$ are reviewed. Apparatus and techniques used in the process are described. (*In Polish.*) Krzemowanie drutów i taśm molibdenowych. ***S. Stolarz.*** *Prace Instytutów Hutniczych,* 1961, no. 6, p. 313-320.

Easy-to-Apply Resin Coatings Block Corrosive Attacks. Permaspray, a new coating system, is easily applied with spray guns, rollers or brushes. *Iron Age,* v. 187, no. 15, Apr. 13, 1961, p. 92-93.

* **New Viewpoints Regarding Properties and Behavior of Hard Surfacing Alloys.** Wear resistance of hard alloys, interaction of plastic and brittle-hard phases, influence of the welding procedure on the wearing strength. (*In German.*) Neue Gesichtspunkte bei der Betrachtung von Eigenschaften und Verhalten harter Auftragslegierungen. ***O. Knotek and I. Birk.*** *Schweissen und Schneiden,* v. 13, Mar. 1961, p. 105-109.

Low Cost Way to Coat Pipe. Powder process applies thick coating quickly. Many different thermoplastics can be used. *Materials in Design Engineering,* v. 53, no. 4, Apr. 1961, p. 10-11.

* **Solvent Effects on the Stereoselectivity of Diels-Alder Reactions.** ***Jerome A. Berson and William A. Mueller.*** *Tetrahedron Letters,* 1961, no. 4, Mar., p. 131-135.

* **Hardfacing Now With Flame-Sprayed Rod.** The technique of hardfacing through the development of new Stellite alloys in rod form. Hard deposits as thin as 0.010 in. can now be applied with fine control of metallurgical structure and depth. *Metalworking Production,* v. 105, no. 16, Apr. 19, 1961, p. 61-63.

Advanced Chemistry. XV. Theoretical Considerations. Modern views on the electronic interpretation of organic reactions. Discusses directive influences in the benzene ring and tautomerism. ***Phillip M. Fisk.*** *Paint Manufacture,* v. 31, Apr. 1961, p. 124-126.

* **Multilayer Metal-Ceramic Coatings for High-Temperature Protection.** Devoted to the application of multilayer refractory metal-oxide type ceramic coatings on graphite-base materials. ***W. L. Aves, Jr.*** *Metal Finishing Journal,* v. 7, no. 76, Apr. 1961, p. 139 + 6 pages.

* **The Accelerated Weathering of Organic Finishes. A Critical Study.** The accelerated weathering systems used in the United Kingdom which employ a carbon arc, a mercury arc and a twin carbon arc with subsidiary chemical treatments, are compared and the degree of correlation claimed with natural weathering is assessed. ***A. A. B. Harvey.*** *Metal Finishing Journal,* v. 7, no. 76, Apr. 1961, p. 129-138.

* **Relation of Unsaturation to Autoxidation Rate of Mixtures of Triglycerides of Natural Fats.** In this work was studied the connection between oxidation intensity and magnitude of iodine numbers of different natural fat samples possessing the same type of triglyceride content. (*In Russian.*) O sviazi nenasyshchennosti i skorosti avtookisleniia smesei triglitseridov prirodnykh zhirov. ***N. S. Drozdov and N. P. Materanskaiia.*** *Akademiia Nauk SSSR, Doklady,* v. 137, no. 3, Mar. 1961, p. 603-605.

Paint Manufacturers Meet Challenge of Plastics. Thicker coatings were latest trend at OCCA exhibition. ***R. H. Chandler.*** *Industrial Finishing* (London), v. 13, Apr. 1961, p. 48-50.

Low Temperature Frits Widen Scope of Vitreous Enamels. Claims that the degree of distortion encountered during the firing process is overcome if steel articles are enameled with the recently developed vitreous enamels which have a firing temperature 500 F below that of conventional enamels. *Industrial Finishing* (London), v. 13, Apr. 1961, p. 43-45.

Survey of Application Data on Baked Phenolic Coatings Used in Process Industries. Consists of eight papers focusing on industrial coatings. ***L. S. VanDelinder.*** *Corrosion,* v. 17, May 1961, p. 9-13.

* **Modification of Dehydrated Castor Oil With Styrene.** Conditions are given for the copolymerization of dehydrated castor oil with styrene in a much shorter time (3-6 hr) than is possible with methods reported. ***M. C. Menon and J. S. Aggarwal.*** *Journal of Scientific & Industrial Research,* v. 20D, Feb. 1961, p. 65-68.

* **Factors Affecting Adherometer Adhesion. The Work of Removal of Organic Coating.** Characterizes the "work of hesion". ***L. Reed Brantley.*** *Journal of Chemical and Engineering Data,* v. 6, no. 2, Apr. 1961, p. 288-289.

Plastic Coatings for Electrical Insulation. Fluidized bed coating process with cellulosic, vinyl, and epoxy resins are described and compared. ***W. R. Pascoe.*** *Electrical Engineering*, v. 80, May 1961, p. 360-363.

Oxidation Resistant Coatings for Molybdenum and Other Refractory Bodies. Process details are given for coating test specimens and production pieces of molybdenum with aluminum silicon. Physical properties developed and results of recent high temperature oxidation and abrasion-erosion tests are covered as well as applicability of the coatings for carbon. ***Philip J. Clough and Paul L. Raymond.*** *American Ceramic Society Bulletin*, v. 40, May 15, 1961, p. 314-315.

* **Roll-Coating Line Primes, Paints, Embosses in One Pass.** Hunter Engineering's new finishing line applies epoxy primer to one or both sides of Al strip before finish coating; can also emboss it before re-coiling. *Modern Metals*, v. 17, no. 4, May 1961, p. 43 + 1 page.

* **Titanium Cohesion With Steel Investigated.** The thickness of the Ti layer has no real effects on the cohesive strength of Ti with steel. The highest strength is obtained at 1000 C and under a 12.75 kg/mm^2 pressure. The depth of the diffusion zone depends on the temperature of deformation and on the pressure. By modifying the pressure, it is possible to control the depth of the diffusion zone. High pressures give less zone depth and *vice versa*. (*In Russian.*) Issledovanie stsepleniia titana so stal'iu. ***I. M. Pavlov and V. N. Brinza.*** *Tsvetnye Metally*, v. 34, no. 4, Apr. 1961, p. 58-61.

* **New Developments in Epoxy Resins. VI. Wide Range of Handling and End-Use Properties Now Available.** Surveys typical electrical grade epoxy compounds and their applications to indicate the modifications possible to achieve the specified handling and end-use properties. The chief points stressed are: viscosity control and handling method at time of application, gel time and temperature, and cured properties as influenced by the processing requirements. Applications are illustrated. ***Henry Lee and Kris Neville.*** *Insulation*, v. 7, May 1961, p. 19-23.

Design Tips for Using Porcelain-Enameled Aluminum Extrusions. Lists where porcelain enameled aluminum extrusions can be used. *Precision Metal Molding*, v. 19, May 1961, p. 61 + 2 pages.

CONTROL SYSTEMS, COMPUTERS, AUTOMATION, CYBERNETICS, AND SYSTEMS ENGINEERING

Data Transmission for the NRL Space Surveillance System. Data are transmitted on eight discrete frequency-modulated carriers in a frequency band from 270 cps through 2455 cps. ***M. G. Kaufman and F. X. Downey.*** *IRE Transactions on Space Electronics and Telemetry*, v. SET-7, no. 1, Mar. 1961, p. 15-20.

Engineering Applications of Analog Computers. Six experiments are presented from the fields of reactor engineering, heat transfer, and dynamics. The mathematical representation for most of these experiments is in the form of nonlinear differential equations. ***Lawrence T. Bryant, Marion J. Janicke, Louis C. Just, and Alan L. Winiecki.*** *U. S. Atomic Energy Commission, ANL-6319*, Feb. 1961, 48 pp. (UF767 Un3.1an Contin.)

Solving Design Problems in All-Magnetic Logic. Survey of general problems of magnetic logic and some of the methods of designing magnetic logic circuits. ***U. F. Gianola.*** *Electronics*, v. 34, no. 18, May 5, 1961, p. 61-66.

Glow-Tube Programmer Controls Neutron Spectrometer Experiments. Multielement glow tubes are used as switches to control sequence of operation. Tubes can be cascaded to provide more than ten individual functions. ***Edward W. Johanson.*** *Electronics*, v. 34, no. 19, May 12, 1961, p. 65-67.

* **Extraterrestrial Linguistics.** What will we say, if we can find a way to say it, to alien intelligent beings we may discover in the universe? ***Solomon W. Golomb.*** *Astronautics*, v. 6, May 1961, p. 46 + 2 pages.

Computers Today. Special report on important trends in design and development of data-processing systems, increasing importance of communications and controls. ***Frank Leary.*** *Electronics*, v. 34, no. 17, Apr. 28, 1961, p. 63-94.

Simulating War Games With Analog Computers. An analog computer simulates a flight of airplanes maneuvering to attack a target, while defense command responds to simulated radar information about the attackers. ***Vincent J. Caggiano.*** *Electronics*, v. 34, no. 17, Apr. 28, 1961, p. 104-107.

* **Digital Computer Calculation of Transition Processes in Synchronous Machines According to the Differential Equations With Periodic Coefficients.** The study indicates the possibility of using automatic digital computers for calculation of electromechanical transition processes in electric systems. (*In Russian.*) Raschet natsifrovykh vychislitel'nykh mashinakh perckhodnykh protsessov v sinkhronnykh mashinakh po differentsial'nym uravneniam s periodicheskimi koeffitsientami. ***B. M. Kagan and E. L. Urman.*** *Elektrichestvo*, 1961, no. 4, Apr., p. 43-48.

Versatile Feedback Amplifier for Computers, Laboratories and Industrial Use. The experimental work on electronic amplifiers carried out in connection with the design and construction of the E.R.A. network analyzer has shown the convenience and economic saving that may be effected by carrying a stock of a few types of standard units. *Electronic Engineering*, v. 33, May 1961, p. 312-316.

* **The Use of Pegasus Autocode in Some Experimental Business Applications of Computers.** Describes some applications of the Pegasus Autocode to a market-research survey, experimental sales forecasts, and quality-control statistics, at a time when a suitable business or statistical autocode compiler was not yet available. The significant features of these applications were the relatively short time taken by program development and the tabulation of results, which helped to demonstrate the potential advantages of a computer in business. ***H. W. Gearing.*** *Computer Journal*, v. 4, no. 1, Apr. 1961, p. 30-34.

* **The Evolution of Design in a Series of Computers, LEO I-III.** Surveys the evolution of the functional and systematic aspects of design in three generations of LEO computers, indicating how the earlier ideas have been extended or generalized. Changes have been made to meet actual needs and are the direct result of experience of designing, building, programming, operating, and maintaining computer equipment over more than a decade. ***J. M. M. Pinkerton.*** *Computer Journal*, v. 4, no. 1, Apr. 1961, p. 42-46.

* **Data Transmission and the New Outlook for the Computer Field.** Describes some of the developments now taking place in data transmission. ***M. V. Wilkes.*** *Computer Journal*, v. 4, no. 1, Apr. 1961, p. 1-9.

* **How Southern Union Developed a New Program for High-Speed Digital Computers.** Concludes that the 704 computer has these several advantages over other methods: performance; simplification; observation; cost; and simplicity. ***A. G. Prasil and R. V. Jebavy.*** *Gas*, v. 37, June 1961, p. 55-60.

* **Table Look-Up Procedures in Language Processing. I. The Raw Text.** A method of addressing memories is described which is very powerful in the processing of natural languages, where the arithmetic or logical operations are either nonexistent or do not lend themselves to algorithmic description. The main feature is the guarantee of initiation of an exhaustive search for a linguistic word at a point just beyond the desired address. Sequential search backwards not only locates an address if it is there but also provides identification of a longest match first. The method is further extended to provide "conditional" addressing by prefixing subsequent addresses from information obtained in earlier searches. ***Gilbert W. King.*** *IBM Journal of Research and Development*, v. 5, no. 2, Apr. 1961, p. 86-92.

* **Analysis of a Basis Queuing Problem Arising in Computer Systems.** A model which describes a basic junction, or queuing structure, arising in a general computing system is subjected to a mathematical analysis. The results consist of several formulas describing the performance of various parts of the system. The feasibility in analyzing general queuing problems in this manner is stated, together with the results of a Monte

Carlo simulation used for comparison purposes. ***P. E. Boudreau and M. Kac.*** *IBM Journal of Research and Development*, v. 5, no. 2, Apr. 1961, p. 132-140.

* **The Non-Integer Integral and Its Application to Control Systems.** Among various kinds of open-loop transfer functions which theoretically satisfy the given specifications, only one of them, the non-integer integral type, satisfies the practical requirement that the system maintains sufficient stability and accuracy even under the strong effects of saturation inherent to the control apparatuses in the loop. The paper discusses fundamental problems concerning the frequency characteristics and the transient response of a control system whose open-loop transfer function is $1/s^k$. The paper also clarifies the relation among various parameters such as overshoot and phase margin with the medium of k, the order of integral. ***Shunji Manabe.*** *Mitsubishi Denki Laboratory Reports*, v. 2, no. 2, Apr. 1961, p. 147-162.

Fluxlok High-Speed Core Memory. This memory provides electrically alterable, random-access, high-speed, nondestructive read, using ferrite cores in a simply wired configuration. Noise or power-supply transients can not change the memory content. Output signals are insensitive to temperature variations from −65 C to +125 C. ***Robert M. Tillman.*** *Instruments and Control Systems*, v. 34, May 1961, p. 866-869.

ELECTRICAL ENGINEERING

* **Limitations on Realizable Response Shapes for Certain Wide-Band Bandpass Amplifier Circuits.** ***R. A. Woodrow.*** *Institution of Electrical Engineers, Proceedings*, v. 108, pt. C, no. 13, Mar. 1961, p. 107-114.

Control of Frequency and Phase Displacement in Transistor Converter Circuits by Means of R-C Networks. ***F. V. Kadri.*** *Communication and Electronics*, 1961, no. 53, Mar., p. 43-48.

An Analysis of Pinhole Punctures in Underground Cable Jackets. Analysis reveals possibility that high voltage may develop across cable insulation although the underground secondary system has no direct connection to overhead lines. ***G. J. Crowdes and C. L. Dawes.*** *Electrical Engineering*, v. 80, May 1961, p. 355-357.

Network Design Analysis for Stereo Discriminators. Complex expressions involved in the transfer function are translated into a single algebraic equation relating the location of the poles to the zero by way of the parameter, the ratio of primary to secondary capacitance. ***John P. Pietrolewicz.*** *IRE Transactions on Broadcast and Television Receivers*, v. BTR-7, no. 1, Apr. 1961, p. 26-33. (TK1 In6.6b Vis.)

* **Determination of Corona-Proof Property of Electro-Insulating Materials by Different Methods.** (*In Russian.*) Opredelenie koronostoĭkosti elektroizoliatsionnykh materialov razlichnymi metodami. ***N. V. Alexandrov, E. A. Kalinina, and S. G. Trubachev.*** *Elektrichestvo*, 1961, no. 4, Apr., p. 61-68.

Designing Printed-Circuit Spiral Antennas. Describes design considerations such as effects of spiral and cavity diameters, spiral rate of growth, type of spiral and antenna-feed structure. Shows how to design a balun for feeding spiral antennas and lists performance criteria of these antennas. ***J. J. Wolfe and R. Bawer.*** *Electronics*, v. 34, no. 17, Apr. 28, 1961, p. 99-103.

* **Aluminum Magnet Wires With Enamel and Fibrous Insulation.** General discussion of achievements in the U.S.S.R. (*In Russian.*) Aliuminevye obmotochnye provoda s emalevoĭ i voloknistoĭ izoliatsieĭ. ***V. A. Privezentsev.*** *Elektrichestvo*, 1961, no. 4, Apr., p. 68-73.

Long-Distance Waveguide Transmission. II. Concludes from the approximate analysis described that the transmission of f.d.m. telephony signals over long distances, using the H_{01} mode in circular waveguide, is possible by frequency modulation of a carrier. ***R. Hamer.*** *Electronic Engineering*, v. 33, May 1961, p. 279-283.

* **Development of the Auto-Transformer Equivalent Circuit Diagram for Symmetrical System Operation.** Besides regarding the circuit for auto-transformers from the usual operational

viewpoint, we can also consider the two partial windings as the windings of an ordinary power transformer. Therefore, two kinds of equivalent circuit diagrams can be given for auto-transformers: the diagram in "partial winding form" and that in "operational form". The conversion expressions for the equivalent circuit diagram impedances and the short-circuit impedances, as well as for the winding impedances, are given. All the conversion expressions are collected into a table. (*In German.*) Entwicklung des Spartransformator-Ersatzbildes für symmetrischen Netzbetrieb. ***Walter Drunk.*** *ETZ: Elektrotechnische Zeitschrift*, v. 82, Ausgabe A, no. 10, May 8, 1961, p. 307-311.

* **The Dynamics of a Subharmonic Oscillator With Linear Dissipation.** A mathematical analysis of the dynamic behavior of subharmonic oscillators (parametrons) is made assuming a nonlinear reactance but a linear dissipation or resistance. Simple equations of motion for the subharmonic and pump amplitudes are derived in the quasistatic, or high-Q, approximation. Numerical solutions are obtained for two cases. The first shows the subharmonic amplitude changing from a small value to its steady state value when a constant pump signal is applied. The second shows decay when the pump signal is removed. ***G. J. Lasher.*** *IBM Journal of Research and Development*, v. 5, no. 2, Apr. 1961, p. 157-161.

* **Improving the Electric Insulation at High Temperature Between Low Voltage Circuits.** Most refractory insulators become ion conductors at high temperature. Polarization processes are applied to the elimination of the effects of D. C. conductivity in the insulator separating two electric circuits with slightly different potentials. A wide surface, negative, auxiliary electrode is mounted near the two circuits; a continuous potential difference of the order of 100 V is established between the electrode and the two circuits. The insulation obtained was of several thousands megohms in D. C. Other applications are mentioned. (*In French.*) Amélioration de l'isolement électrique a haute température entre circuits a basse tension. ***Hervé Guyot.*** *Recherche Aéronautique*, 1961, no. 81, Mar.-Apr., p. 23-30.

* **The Logmotor—A Cylindrical Brushless Variable-Speed Induction Motor.** Describes a transformer arrangement giving a multiphase output, which can provide such a "phase-stretching" system to be used to supply the stator of a squirrel-cage induction motor. The primary and secondary of the transformer are analogous to the C and D sacles of a slide-rule, and movement of the primary relative to the secondary results in a variation of the phase increment between adjacent secondary coils. ***F. C. Williams, E. R. Laithwaite, J. F. Eastham, and L. S. Piggott.*** *Institution of Electrical Engineers, Proceedings*, v. 108, pt. A, no. 38, Apr. 1961, p. 91-99.

* **Luminous Mimic Diagrams for Communication Techniques.** Luminous mimic diagrams serve for the central supervision (and control) of long-range communications networks and devices. They are large functionally arranged block diagrams using the customary symbols. (*In German.*) Leuchtschaltbilder für die Nachrichtentechnik. ***Max Jung.*** *Frequenz*, v. 15, Apr. 1961, p. 128-132.

* **The Design of Filters With the Help of the Catalogue of Normalized Low-Passes.** Tables show the normalized values of the circuit elements of the Tchebyscheff low-pass filters and Cauer parameter low-pass filters with resistive termination at either end for the degrees n = 4 to n = 11 different reflection coefficients p at a time (and for 11 different maximum variations of the insertion loss within the pass-band in each case, respectively). (*In German.*) Der Entwurf von Filtern mit Hilfe des Kataloges normierter Tiefpässe. ***R. Saal.*** *Frequencz*, v. 15, Apr. 1961, p. 111-121.

Introduction to Circuit Analysis. Offers a clearly presented and usefully organized approach to the fundamentals of linear circuit analysis. The book's application is three-fold: a basic introduction to circuit analysis for electrical engineering students, a more modern and comprehensive treatment for non-electrical engineering students, and a presentation useful for core-type programs. Intends to impart a better understanding of the process of solving differential equations, the meaning of various parts of the total response of a circuit, and the relationship of these parts to the circuit and its initial energy-storage states. Includes a review of the potential-current relations in resistance, inductance and capacitance. ***John D. Cowan, Jr.***

and Herbert S. Kirschbaum. 312 pp. 1961. Charles E. Merrill Books, Inc., Columbus, Ohio. (TK3226 C83i)

* **The Behavior of Air Blast Circuit Breakers Around Current Zero (A Study of the Time Constant of Dynamic Arcs).** The dynamic behavior of arcs around current zero is of most importance for circuit breaker performance. As for air-blast circuit breakers, however, the experimental or theoretical studies of the subject were considerably difficult so far. Special measuring devices, which were recently developed in our laboratory, have enabled us to make detailed experimental investigations. By several air-blast breaker models, reliable data for inherent time constant of the dynamic arc have been obtained from precise recording of post-arc and precurrent-zero transients. An approach to the theoretical confirmations of the time constant has also been made and the experimental results have been successfully explained. ***Tsuneo Ushio and Toshio Ito.*** *Mitsubishi Denki Laboratory Reports*, v. 2, no. 2, Apr. 1961, p. 121-145.

ELECTROCHEMISTRY

* **Electroless Gold Plating.** ***S. Duffield Swan and E. Lamar Gostin.*** *Metal Finishing*, v. 59, Apr. 1961, p. 52-53.

* **Electrodeposited Lead Oxide.** A study on the electrode behavior of the electrodeposited lead oxide and of the lower oxide which was formed by thermal decomposition of electrodeposited PbO_2. The probable nature of the oxides was deduced from voltage, oxygen content, and X-ray diffraction measurements. ***Shinichi Ikari and Shiro Yoshizawa.*** *Electrochemical Society of Japan, Journal* (Overseas Ed.) v. 28, nos. 7-9, 1960, p. E150-E152.

* **Fuel Cells. Present Status of the Direct Conversion of Chemical Into Electric Energy.** Reviews the different types of fuel cells, stressing the thermodynamic and kinetic aspects of various electrode processes. Some aspects of special interest to the chemical industry are discussed. (*In Italian.*) Le pile a combustibile. Stato attuale del problema della conversione diretta dell'energia chimica in energia elettrica. ***Giuseppe Bianchi.*** *Chimica e l'Industria*, v. 43, Mar. 1961, p. 271-277.

* **On the Thermodynamical Properties of Fused $ZnCl_2$ (*1*)-[LiCl, KCL (Eutectic)] (*1*) System.** Paper deals with electromotive force of the cell, Zn(*1*)/ZnCL(*1*)(N_1)-[LiCL-(43.9wt%),KCL](*1*)(N_2), 1 atom. Cl_2(g)/C. ***Masao Takahashi.*** *Electrochemical Society of Japan, Journal* (Overseas Ed.) v. 28, nos. 7-9, 1960, p. E117-E120.

An Investigation of Columbium as an Electrolytic Capacitor Metal. Capacitors were very similar to those prepared from tantalum. Solid columbium capacitors were better in a severe nuclear environment. ***A. Shtasel and H. T. Knight.*** *Electrochemical Society, Journal*, v. 108, Apr. 1961, p. 343-347.

The Kolbe Electrolysis as a Source of Free Radicals in Solution. III. Some Aspects of the Stereochemistry of the Electrode Process. The electrolysis of a methanolic solution of potassium propionate in the presence of butadiene yields the *trans* isomer only of 4-octene. The electrolysis of a methanolic solution of potassium acetate in the presence of cyclohexadiene was found to result in both *cis*- and *trans*-1,2- and 1,4-addition of methyl groups to the diene. ***William B. Smith and Hans-Georg Gilde.*** *American Chemical Society, Journal*, v. 83, Mar. 20, 1961, p. 1355-1358.

* **Fuel Cells.** Efforts may lead to commercial exploitation within the next five years, the first cells for operation on commercial hydrocarbon fuels will be high-temperature cells running above 400 C. The first commercial batteries are likely to replace small-motor generator sets of up to 20 *kW* output. ***H. H. Chambers.*** *North East Coast Institution of Engineers & Shipbuilders, Transactions*, v. 77, pt. 6, Apr. 1961, p. 379-390.

Thermodynamics of Thermally Regenerated Fuel Cells. Formulas are given for calculating the theoretical efficiency. Curves show calculated efficiencies for hypothetical thermodynamic data chosen to illustrate the effect of thermodynamic properties on efficiency. ***J. B. Friauf.*** *Journal of Applied Physics*, v. 32, Apr. 1961, p. 616-620.

* **Cathodic Polarization During the Joint Cathodic Discharge of Iron, Cobalt and Hydrogen Ions and Reduction of Fe^{3+} to Fe^{2+}.** For solutions of cobalt and iron sulfates of pH values 3.5, 1.8 and 1.5, besides the formation of alloys at the cathode, depolarization of iron and superpolarization of cobalt take place. Deposition of the alloy at all temperatures investigated becomes more difficult with increasing hydrogen ion concentration. The activation energies of hydrogen ion discharge and the exchange current on the cobalt–iron alloy have been calculated. (*In Russian.*) Katodnaia poliarizatsiia pri sovmestnom razriade ionov zheleza, kobal'ta i vodoroda. ***A. L. Rotinian and E. N. Molotkova.*** *Zhurnal Fizicheskoĭ Khimii*, v. 35, no. 1, Jan. 1961, p. 158-163.

* **Oscillographic Study of the Kinetics of Electrodic Processes. II. The Cobalt Electrode in Cobalt Sulfate Solutions.** On the basis of oscillographic measurements it has been shown that the kinetics of discharge and ionization of cobalt in cobalt sulfate solutions obey the slow discharge theory. From the oscillograms of the breaking of the anodic polarizing current the values have been determined of the exchange current of cobalt and of the α coefficient in cobalt sulfate solutions of various concentration. The coefficient is independent of the concentration and is equal to 0.65. (*In Russian.*) Ostsillograficheskoe issledovanie kinetiki elektrodnykh protsessov. II. Kobal'tovyi elektrod v rastvorarkh sul'fata koval'ta. ***V. A. Zinov'ev, A. B. Sheinin, and V. L. Kheifetz.*** *Zhurnal Fizicheskoĭ Khimii*, v. 35, no. 1, Jan. 1961, p. 98-101.

* **Quantitative Expression for the Lyotropic Effect of Ions on the Properties of Aqueous Electrolyte Solutions.** Three viscosity difference values $\Delta\eta$, $\Delta\eta_i$ and $[\Delta\eta]$, have been calculated for 71 aqueous electrolyte solutions over wide ranges of concentration and temperature. The calculations were made partially on the basis of the author's data. The differences have been interpreted as additional structural viscosities. The individual intrinsic viscosities $[\Delta\eta_i]$ have been calculated for 15 cations and 12 anions, the values being presented as quantitative indices of the lyotropic effect of the ions. (*In Russian.*) O sravnitel'noi otsenke liotropnogo deĭstviia ionov na svoĭstva vodnykh rastvorov elektrolitov. ***A. P. Rutskov.*** *Zhurnal Fizicheskoĭ Khimii*, v. 35, no. 1, Jan. 1961, p. 3-8.

* **Effect of SO_2 Additions on the Electrolysis and Properties of Manganese Deposits.** Three different regions of the action of SO_2 additions have been established, depending upon the pH of the solution. At pH values above 6.0, SO_2 has no influence on the course of the electrolysis, not existing in the free state under these conditions. At pH below 6.0, the presence of SO_2 brings about chemical reactions as a result of which quadri- and trivalent manganese ions are reduced to the bivalent form. At pH values below 4.0, SO_2 besides participating in the chemical reactions also takes part in the electrodic processes. (*In Russian.*) Vliianie dobavki SO_2 na elektroliz i svoĭstva osadkov margantsa. ***A. T. Sanzharovskii.*** *Zhurnal Fizicheskoĭ Khimii*, v. 35, no. 1, Jan. 1961, p. 20-25 + 3 plates.

* **Plated Coatings in Boriding of Steel.** The use of various electroplated coatings in boriding gives different results. Nickel plated samples form a borided layer of a normal structure. Copper plating prevents boron from diffusing into steel. ***Larissa Domnikov.*** *Metal Finishing*, v. 59, Apr. 1961, p. 49 + 3 pages.

* **Development of Electrochemical Industries Utilising Sea Water as Raw Material.** The future prospects of various methods proposed or practiced for recovering Na, K, Mg, and Ca compounds from sea water are discussed with special reference to the development of electrochemical industries in India. ***V. Aravamuthan.*** *Electrochemical Society, India Section, Bulletin*, v. 10, no. 1, Jan. 1961, p. 11 + 4 pages.

* **Electrolytic Destruction of Cyanide Residues.** ***John M. Connard and G. Paul Beardsley.*** *Metal Finishing*, v. 59, May 1961, p. 54-55.

* **Electrodeposition of Iron-Zinc and Nickel-Zinc Alloys: Cathode Potentials and Structure.** The results on cathode potentials and structure in the two systems are presented. ***Vasanta Sree, S. K. Panikkar, and T. L. Rama Char.*** *Electrochemical Society, India Section, Bulletin*, v. 10, no. 1, Jan. 1961, p. 8-10.

* **Chrome Plating High-Loaded Components.** Work hardening the surface by rolling with rollers prior to plating offers a good solution for the problem of neutralizing the harmful tensile stresses arising as a result of chromium plating. ***Larissa Domnikov.*** *Metal Finishing*, v. 59, May 1961, p. 66 + 1 page.

An Experimental Investigation of the Electrolytic Grinding Process. Data are presented covering the effect of several variables on grinding rate for the electrolytic grinding process. The relative amount of material removal due to electrolysis and due to conventional grinding action was investigated. The Faraday current efficiency of the electrolytic part of the process was found to be near 100% to the extremely high current density of 700 amps per sq in. This is thought to result from the scraping action of the wheel abrasive which prevents passivation of the work anode. Several phenomena of the process are explained on the basis of hydrogen gas pressure in the work-wheel interface. A formula is presented for calculating the hydrogen gas pressure. Equations are proposed for the basic chemical reactions of the process. ***Reno R. Cole.*** *ASME, Transactions, Series B, Journal of Engineering for Industry*, v. 83, no. 2, May 1961, p. 194-201.

* **Effects of the pH on the Anodic Oxidation of Lead Amalgam.** Studies the reduction capacity of Pb amalgam by polarography and by using a diluted amalgam as a drop electrode. The $E_{\frac{1}{2}}$ an. potential was measured as a function of the pH. From pH 0 to 6.5, $E_{\frac{1}{2}}$ an. is constant and equal to −0.34 ± 0.01 V/ECS. It decreases such as −0.05 pH down to pH 13.5, then as −0.12 pH down to pH 14. The Pb (g)/Pb^{++} is rapid in an alkali medium. (*In French.*) Influence du pH sur l'oxydation anodique de l'amalgame de plomb. ***Mylène Bréant and Jean-Claude Merlin.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 252, no. 16, Apr. 17, 1961, p. 2410-2412.

ELECTRONICS

* **A New Variant of the Modified Two Terminal Network Method for the Determination of Semiconductor Diode Contact Impedances in Microwaves.** By means of the method described, it is possible to determine complex impedances of contact in a socket, to frequencies of 9400 megahertz with any design of the diode head. (*In Russian.*) Novyĭ variant metoda chetyrekhpoliusnika dlia opredeleniia soprotivleniĭ kontaktov poluprovodnikovykh diodov v diapazone SVCh. ***Iu. F. Sokolov.*** *Radiotekhnika i Elektronika*, v. 6, no. 3, Mar. 1961, p. 399-405.

* **Generalizing Full Impedance Diagram in the Case of Microwave Channels With Negative Resistance.** A circular diagram of these impedances was applied to channels with concentrated and distributed negative resistances. The coefficient of reflection becomes higher than the unit and the operating region of the full impedance exceeds the limits of the periphery of the unit radius. Some cases of negative impedances were considered, where by inversion it is possible to use a circular diagram of the usual type. (*In Russian.*) Obobshchenie krugovoĭ diagrammy polnykh soprotivleniĭ na sluchaĭ traktov SVCH s otritsatel'nym soprotivleniem. ***N. M. Sovetov.*** *Radiotekhnika i Elektronika*, v. 6, no. 3, Mar. 1961, p. 371-374.

* **An Improved Model for Flux Reversal in Ni-Fe Cores.** Develops a quantitative model for the mechanism of flux reversal in nickel-iron cores. The model allows the prediction of the instantaneous values of magnetic flux during reversal as a function of the applied magnetic-field intensity. Emphasis is placed upon the applicability of the results to practical engineering problems as well as the adherence of the model to the physical description of the process. ***I. Leliakov and F. J. Friedlaender.*** *Communication and Electronics*, 1961, no. 53, Mar., p. 23-26.

* **Forced Oscillation in an Oscillator With Two Degrees of Freedom.** Oscillations are determined theoretically by van der Pol's method of approximation and verified experimentally by an electronic differential analyzer. An experimental method for obtaining the phase trajectories is described. ***B. R. Nag.*** *Institution of Electrical Engineers, Proceedings*, v. 108, pt. C, no. 13, Mar. 1961, p. 93-97.

* **The Output Spectral Density of a Detector Operating on a F.M. C.W. Radar Signal in the Presence of Band-Limited White Noise.** A method of approximation which may be used in most practical cases and states the restrictions on system parameters for which the approximations are valid. ***J. Lait and A. J. Hymans.*** *Institution of Electrical Engineers, Proceedings*, v. 108, pt. C, no. 13, Mar. 1961, p. 197-207.

Modulation in Nonlinear Filters With Parametric Feedback. ***D. A. Robinson.*** *IRE Transactions on Circuit Theory*, v. CT-8, no. 1, Mar. 1961, p. 60-66.

* **New Distortion Criterion. I. Audience Reaction to Non-Linearity Distortion.** The optimal design of line amplifiers, amplifiers for loudspeakers, modulators for radio transmitters, and the like, cannot be achieved until the rate of exchange has been established between the degree of distortion and the resulting deterioration of program quality. Here an attempt is made to establish this rate of exchange. ***E. R. Wigan.*** *Electronic Technology*, v. 38, Apr. 1961, p. 128-137.

* **The Theory of Waveguides and Cavities. II. Examples of Waveguides and Discussion of Special Points.** A general approach is applied to two examples, the guide consisting of a metal tube of circular cross-section enclosing air, and the coaxial line, taking the core material to be a general dielectric instead of a perfect conductor. ***R. A. Waldron.*** *Electronic Technology*, v. 38, Apr. 1961, p. 140-147.

* **Amplification of Low Power Periodic Signals.** The method described permits the observation of practically undistorted signals. Following the periodic signal under high frequency conditions, the method of spectrum transformation used allows a definite increase (by hundreds of times) of the signal-noise ratio. The basic amplification and the observation of the signal with a very wide frequency spectrum can be carried out with low-frequency devices. (*In Russian.*) Usilenie periodicheskikh signalov maloi moshchnosti. ***B. A. Mamyrin.*** *Radiotekhnika*, v. 16, no. 3, Mar. 1961, p. 47-53.

Esaki Diodes. Device may serve as a source of microwave power as well as a high-speed switch. ***George C. Dacey.*** *Bell Laboratories Record*, v. 39, Apr. 1961, p. 122-125.

Antenna Steering for Echo I. The energy of radio waves reflected from Echo I was about one millionth of a billionth of a watt. Design of an extremely accurate system to steer the antennas is given. ***R. Klahn.*** *Bell Laboratories Record*, v. 39, Apr. 1961, p. 126-129.

Properties of Tropospheric Scattered Fields. Tests were performed in the Southern California region in conjunction with extensive meteorological measurements. ***N. R. Ortwein, R. U. F. Hopkins, and J. E. Pohl.*** *I.R.E. Proceedings*, v. 49, Apr. 1961, p. 788-802.

Multiple Beams From Linear Arrays. Considers devising a passive RF transmission line feed system to provide independent multiple outputs from a linear array. Shows that a lossless, matched-feed network is possible only for uniform aperture distribution. ***J. P. Shelton and K. S. Kelleher.*** *IRE Transactions on Antennas and Propagation*, v. AP-9, no. 2, Mar. 1961, p. 154-161.

Scatter Communications With Radar Chaff. Concerned with finding an analytical expression for the scattering cross section of chaff oriented randomly within a vertical cone. ***R. A. Hessemer, Jr.*** *IRE Transactions on Antennas and Propagation*, v. AP-9, no. 2, Mar. 1961, p. 211-217.

On the Reception of Electromagnetic Waves. The energy that can be obtained from an electromagnetic wave by a localized receiver is considered for the nonharmonic case. If the currents in the receiver are chosen so as to maximize the amount of energy obtained, with conditions implying that the receiver is quiescent outside a finite interval of reception, then there exists a well-defined maximum. ***H. Bondi.*** *Royal Society, Proceedings*, v. 261, Ser. A, Apr. 11, 1961, p. 1-9.

* **Bent Rectangular Section Waveguide.** The structure of an electromagnetic field in the circular bends of this type of waveguide was examined; approximative expressions were calculated for the fields in the bent waveguide and for their coefficients of distribution; the expressions, consisting of elementary functions, are perfectly suitable for practical calculations. (*In Russian.*) Izognutyĭ volnovod priamougol'nogo secheniia. ***M. Zh. Kisliuk.*** *Radiotekhnika*, v. 16, no. 4, Apr. 1961, p. 3-10.

Subminiature Tubes for VHF-UHF. Several triode RF amplifier tubes have been developed for Television receiver usage which have contributed significant improvement in noise figure. ***T. Gausman.*** *IRE Transactions on Broadcast and Television Receivers*, v. BTR-7, no. 1, Apr. 1961, p. 21-25. (TK1 In6.6b Vis.)

Advances in Electronics and Electron Physics. Six papers covering the following subjects: the electron as a chemical entity; problems of photoconductivity; strong-focusing lenses; hydrogen thyratrons; Cerenkov radiation at microwave frequencies; and high-power axial-beam tubes. ***L. Marton and Claire Marton, editors.*** v. XIV. 341 pp. 1961. Academic Press, New York. (TK161 A95e Vis.)

* **Deep-Space Communications. II.** Considers power conversion, transmission frequency, system particulars, and tracking requirements. ***Eberhardt Rechtin.*** *Astronautics*, v. 6, May 1961, p. 26 + 4 pages.

* **Practical Problems of Satellite Communication.** To achieve a practical system soon, we must weigh world conditions, unknowns of space, and other factors against the resources of a sophisticated electronics art. ***John R. Pierce.*** *Astronautics*, v. 6, May 1961, p. 34 + 5 pages.

* **Symmetrical Irradiation of Finite Dimension Bodies With Rotation Symmetry.** The precise determination of the Kirchhof approximation for such bodies whose surfaces have fissures is based on the approximate calculation of the perturbance of the field by the fissure and is conducted for the case of irradiation of bodies along their axis of symmetry. The effective surface of dispersion of the finite cone and of the rotation paraboloid is calculated. (*In Russian.*) Simmetrichnoe obluchenie konechnykh tel vrashcheniia. ***P. Ia. Ufimtsev.*** *Radiotekhnika i Elektronika*, v. 6, no. 4, Apr. 1961, p. 559-567.

Monostable Pulse Generator Employs Zener-Diode Clamp. A simple circuit that produces pulses of known length and amplitude when triggered by an external pulse. ***C. M. Stewart.*** *Electronics*, v. 34, no. 19, May 12, 1961, p. 76-77.

* **Interference Killing Feature of Integral Signal Reception During the Action of Fluctuating and Sinusoidal Interferences.** Comparison of the interference killing feature of integral and ordinary narrow-band reception of pulse signals during the action of fluctuating and sinusoidal interferences. (*In Russian.*) Pomekhoustoĭchivost' integral'nogo priema signalov pri vozdeĭstvii fluktuatsionnykh i sinusoidal'nykh pomekh. ***N. L. Teplov.*** *Elektrosviaz'*, v. 15, no. 4, Apr. 1961, p. 9-18.

* **Simple Electronic Apparatus for Statistical Studies in the Field of Radio Wave Propagation.** Description of electronic apparatus for direct determination of the average field strength. (*In Russian.*) Prostoĭ electronnyĭ pribor dliia staticheskikh issledovaniĭ v oblasti pasprostraneniia radiovoln. ***N. S. Stanulov.*** *Elektrosviaz'*, v. 15, no. 4, Apr. 1961, p. 28-34.

* **Standardization of Ridged Waveguides.** ***Tore N. Anderson and Leonard I. Kent.*** *Microwave Journal*, v. 4, Apr. 1961, p. 74-78.

* **The Lincoln Laboratory Antenna Test Range.** The range consists of four measuring stations, three of which have a transmission distance of 2,000 feet (the long range) and the fourth, a transmission distance of 720 feet (the short range). ***Albert Cohen and A. W. Maltese.*** *Microwave Journal*, v. 4, Apr. 1961, p. 57-65.

* **Approximate Calculation of Proper Values of Higher Types of Waves in Strip Lines.** The longitudinal wave propagation is reduced to a transversal with subsequent application of the functional equation method. The calculated and the experimental curves of phase speed are mentioned. (*In Russian.*) O priblizhennom raschete sobstvennykh znacheniĭ vysshikh tipov voln v poloskovykh liniiakh. ***G. P. Samuilov.*** *Radiotekhnika i Elektronika*, v. 6, no. 4, Apr. 1961, p. 579-583.

a * **Television Anomalies—Past, Present and Future.** ***L. H. Bedford.*** *British Institution of Radio Engineers, Journal*, v. 21, Apr. 1961, p. 291-299.

b * **Radiocommunication in the Power Industry.** Draws attention to some of the problems which have been encountered in the planning and operation of mobile and fixed v.h.f. radio links. ***E. H. Cox and R. E. Martin.*** *Institution of Electrical Engineers, Proceedings*, v. 108, pt. A, no. 38, Apr. 1961, p. 153-168.

c * **Electricity and Electronics in Aviation.** Ways in which aircraft and air traffic rely on various applications of electrics and electronics; the necessity for reliability is specially emphasized. ***Viscount Caldecote.*** *Institution of Electrical Engineers, Journal*, v. 7, no. 76, Apr. 1961, p. 212-214.

d **Network Synthesis With Negative Resistors.** Shows that if the negative resistor is added to the usual set of lumped passive building blocks, then it is possible to represent as a network any linear relation between *n*-port voltages and currents prescribed in terms of real, rational functions of a complex-frequency variable. ***H. J. Carlin and D. C. Youla.*** *I.R.E. Proceedings*, v. 49, May 1961, p. 907-920.

ENGINEERING ECONOMICS

e **Problem in Decentralized Financial Control.** Describes a new approach to calculating the current investments of a company division. ***John Dearden.*** *Harvard Business Review*, v. 39, no. 3, May-June 1961, p. 72-80.

f **More Government in Business.** The new frontier raises questions about an old frontier. What developments can we and should we expect in the ever-growing area where private and public enterprise impinge upon each other? ***John J. Corson.*** *Harvard Business Review*, v. 39, no. 3, May-June 1961, p. 81-88.

Cooperation to Solve the Gold Problem. The U. S. dollar crisis is the symptom of a deeper, more persistent difficulty; we must change our approach from worrying about the present to preparing for the future. ***Henry C. Wallich.*** *Harvard Business Review*, v. 39, no. 3, May-June 1961, p. 47-56.

g * **Feasibility Study Outline.** Outlines a series of reports to be published in future issues, discussing chances of a venture being successful and where to locate it. *Industrial Development*, v. 130, no. 4, Apr. 1961, p. 73 + 3 pages.

h * **International Shoe Thinks Through Site Selection.** Fifty years of experience and the operation of 60 separate plants has led International Shoe to systematize its site selection process. ***Henry H. Rand.*** *Industrial Development*, v. 130, no. 4, Apr. 1961, p. 10-13.

i * **Forty Leading Markets for Metalcasters Today.** Tonnage and dollars revealed in special analysis of new census data. Also, special breakdowns presented for gray and malleable iron, steel, aluminum-base, and copper-base castings. For the first time, information on captive foundry operation is given. *Modern Castings*, v. 39, May 1961, p. 52-58.

j * **The Top Ten Plants of 1961.** Here is a collection of good-looking, productive facilities packed with profitable ideas that can be put to work by plant men everywhere, regardless of the size or age of the plant they work in. *Factory*, v. 119, May 1961, p. 77-121.

k * **The Engineer in Commonwealth Development.** Stresses particularly the need for engineers to acquire a broad general education so as to be able to appreciate the magnitude of the problems of Commonwealth development, not only technologically, but also in a more human sense. ***The Duke of Edinburgh.*** *Engineer*, v. 211, Apr. 21, 1961, p. 652-654.

* **Cooperation for Development.** Economic development for underdeveloped nations is a must. A forum is urgently needed through which the task can be totaled and plans drawn for the maximum cooperation of all—givers and recipients of aid. Even

more important is what the forum is empowered to do. ***Lorie Tarshis.*** *SRI Journal,* v. 5, 2nd Quarter, 1961, p. 67-71.

Pressure From Depreciation Throttles U. S. Business. America's archaic depreciation laws are forcing U. S. industry to underdepreciate at the rate of about $6.5 billion a year. No real profit growth is possible until we get depreciation reform. *Steel,* v. 148, May 8, 1961, p. 81-84.

* **Entrepreneurs: Key to Growth.** A wide gulf separates the entrepreneur from even the successful manager, who guides well but only in accepted patterns. Entrepreneurs are rare, but society must have them for economic development at any stage. They should be sought out and provided a favorable climate. ***Maurice Zinkin.*** *SRI Journal,* v. 5, 2nd Quarter, 1961, p. 43-48.

Building in Aretic Canada. Permanently frozen ground would melt if heated buildings were erected on it; site selection to avoid this danger is therefore of great importance. ***Robert F. Legget.*** *New Scientist,* v. 10, Apr. 13, 1961, p. 42-45.

An Econometric Model of Growth—The British Economy in Ten Years Time. Until the development of large electronic computers, detailed analyses of the economic system were too complex to be attempted. This article describes the beginnings of an econometric study that is being undertaken at Cambridge with the help of the computer EDSAC. ***Richard Stone.*** *Discovery,* v. 22, May 1961, p. 216-219.

The Pressure From Government. Gives details on the numerous and complex agencies regulating industry and the reforms in some of them proposed by President Kennedy. *Steel,* v. 148, May 22, 1961, p. 83-86.

American Might and Soviet Myth. The author, editor of the *Indianapolis Star,* believes that until the United States begins again to operate its own foreign policy in the interests of its own people, and to follow its own historic principles and to reestablish its authentic national character, it will continue to fail and the Soviet Union will continue to win the cold war. ***Jameson G. Campaigne.*** 218 pp. 1960. Henry Regnery Co., Chicago. (E183.8.R9 C15a)

* **The Money-Makers (and Some Losers): What the Reports Show.** Profit margins declined last year for most of the publicly held construction companies. It was the same old villain: tight competition forced bids to rock bottom. But some beat the market with profitable sidelines, specialties and negotiated contracts. ***Robert J. Stinson, editor.*** *Engineering News-Record,* v. 166, no. 20, May 18, 1961, p. 212 + 3 pages.

FLUID MECHANICS

Control of Blowers. Need for mass-flow control complicates the choice of blower drive. ***G. H. Inglis.*** *Control,* v. 4, no. 34, Apr. 1961, p. 93-97.

The Mathematical Theory of Capillarity. I-III. The problems of static meniscus formation and shallow wave motion on incompressible, inviscid fluids are reviewed. ***F. C. Goodrich.*** *Royal Society, Proceedings,* v. 260, ser. A, Mar. 21, 1961, p. 481-509.

FOOD TECHNOLOGY

* **Magnesium Content of Accessory Foods.** Selected beverages, condiments, sweets, and other accessory foods used in controlled dietary studies were analyzed for Mg. *Ad libitum* intake of coffee or tea could contribute significantly to the Mg content of the diet. ***Gweneth Y. Nelson and Mary R. Gram.*** *American Dietetic Association, Journal,* v. 38, May 1961, p. 437-438.

Conference on Frozen Food Quality. Held at Albany, Calif., Nov. 4-5, 1960. The discussions centered on problems in the packing, transport, warehousing, distribution, and retailing of frozen foods—particularly those related to recent proposals for performance standards in frozen-food handling from

packer to consumer. *U. S. Agricultural Research Service,* ARS-74-21, 84 pp. (S584 Un3.1ar Contin.)

* **Studies on the Irradiation of Microorganisms in Relation to Food Preservation. I. The Comparative Sensitivities of Specific Bacteria of Public Health Significance. II. Irradiation Resistant Mutants.** ***I. E. Erdman, F. S. Thatcher, and K. F. MacQueen.*** *Canadian Journal of Microbiology,* v. 7, no. 2, Apr. 1961, p. 199-215.

Proteolytic Enzyme Activity During Storage of Radiation-Stabilized Raw Beef and Its Significance to Flavor. A decrease in consumer-type taste-panel preference during unrefrigerated storage of irradiated (4.5 megarad) raw ground beef correlates to some extent with the action of endo-cellular tissue proteolytic enzymes (cathepsins). ***Maurice P. Drake, Gerald D. Gernon, Jr., and Fred J. Kraus.*** *Journal of Food Science,* v. 26, no. 2, Mar.-Apr. 1961, p. 156-162.

* **Spray-Drying of Tomato Puree, Groundnut and Soybean Proteins and Sugar-Gelatin Solutions.** The tomato puree did not need the addition of a carrier provided that the air plenum of the drier was suitably modified. Spray-drying did not change the color of tomato puree and the protein solutions, the viscosity characteristics of the protein solutions, or the nutritive value of the proteins. ***G. Evans.*** *Journal of Biochemical and Microbiological Technology and Engineering,* v. 3, no. 1, Apr. 1961, p. 65-77.

Ingenious Process Guards Citrus Oil Quality. Volatiles are entrapped as microscopic oil globules in a matrix of corn-syrup solids. The flavor is released only when the product is dissolved. Typical applications include flavoring of hydrated orange or lemon juices, or ades. Individual "locked in" flavors can be mechanically mixed to solve the problem of stabilizing flavor blends that otherwise would not be compatible because of chemical interaction during storage. A case in point is blending orange oil and methyl anthranilate. *Food Engineering,* v. 33, May 1961, p. 97-98.

FUELS AND COMBUSTION

Heat of Combustion of Borazine, $B_3N_3H_6$. ***Marthada V. Kilday, Walter H. Johnson, and Edward J. Prosen.*** *U. S. National Bureau of Standards, Journal of Research, Section A, Physics and Chemistry,* v. 65A, no. 2, Mar.-Apr. 1961, p. 101-104.

* **A New Method of Preparing Coking Batches.** Method permits a sharp decrease of the content in the batch from <0.5 mm to 35%. During a prolonged work of the plant involving charged crushing, the size of coke increased because of the increase of the >80 mm content. The composition of the chemical coking products improved. The number of working crushers was reduced to one. The productivity of the coke furnaces was enlarged to 3-3.5%. When maintaining the prodution on the previous level the coking period was increased to 25 min. (*In Russian.*) Novaia sxhema podgotovki shikhty dlia koksovaniia. ***P. Ia. Kuleshov, et al.*** *Koks i Khimiia,* 1961, no. 3, p. 5-8.

* **Something New in the Field of Soda-Arsenate Purification of Gas.** Uninterrupted melting of S foam can be introduced into all operating soda-arsenate plants. Continuous neutralization must be recommended for introduction into the other plants. The passage to steady processes permits complex automation of soda-arsenate S purifiers. The production of colloidal S increases the economy of the plant. (*In Russian.*) Novoe v rabote mysh'iakovo-sodovoĭ ochistki gaza. ***N. A. Prokopenko and L. N. Lylova.*** *Koks i Khimiia,* 1961, no. 3, p. 52-54.

Stability of Laminar Flames. Markstein theory is shown to be supported by experimental results on oscillated laminar propane-air flames. ***Russell E. Petersen and Howard W. Emmons.*** *Physics of Fluids,* v. 4, no. 4, Apr. 1961, p. 456-464.

Measurement of Particle and Gas Temperatures in a Slightly Luminous Premixed Flame. Particle and gas temperatures were independently measured above a 7.0-cm-diam flat, premixed ethylene-air flame. ***Roger C. Millikan.*** *Optical Society of America, Journal,* v. 51, May 1961, p. 535-542.

Discontinuity Properties of Laminar Flames. An experimental investigation has been made to test the basic hypotheses of published infinite and finite two-dimensional flame front theories, in which the flame is considered to be a surface of discontinuity, in properties, between reactant and product flow fields. The "particle track" method was used, in which a controlled quantity of magnesium oxide particles was introduced into the flow. ***Tony Maxworthy.*** *Physics of Fluids*, v. 4, no. 5, May 1961, p. 558-564.

* **Atomisation of Liquid Fuel for Combustion.** Concludes with data of general applicability on the performance criteria of atomisers such as flow rate, spatial configuration of the spray, and drop size. ***Paul Eisenklam.*** *Institute of Fuel, Journal*, v. 34, Apr. 1961, p. 130-143 + 4 plates.

* **The Metallic Recuperator.** The design, development and application of the recuperator as a means of waste heat recovery from industrial furnaces. ***W. A. Mellor.*** *Fuel Efficiency*, v. 9, Apr. 1961, p. 42 + 5 pages.

* **Effect of Initial Mixture Density on the Formation of Detonation in Knallgas Saturated With Water Vapor.** Reports the effect of density on the formation of detonation and the detonation limits in a particular experimental system for a saturated knallgas-steam mixture. This mixture is of particular interest in the atomic energy field as it may be encountered in aqueous homogeneous reactors. ***James A. Luker and Edward C. Hobaica.*** *Journal of Chemical and Engineering Data*, v. 6, no. 2, Apr. 1961, p. 253-256.

GEOLOGY, GEOPHYSICS, MINERALOGY, AND MINING ENGINEERING

* **Weather Thickens—It's a Plot.** Electronic plotter mechanically draws a complete map of the Northern Hemisphere in less than three minutes. Device reads weather information supplied in numerical form on magnetic tape and presents the information to a digital-to-analog converter. *Industrial Science and Engineering*, v. 8, no. 4, Feb. 1961, p. 19-20.

* **High-Energy X-Rays During Solar Flares.** ***J. I. Vette and F. G. Casal.*** *Physical Review Letters*, v. 6, no. 7, Apr. 1, 1961, p. 334-336.

Solar and Wind Energy. Developments in the methods of harnessing these natural sources of power and the economic problems which are considerable. ***E. W. Golding.*** *Research Applied in Industry*, v. 14, Mar. 1961, p. 82-87.

* **Hydrodynamic Long-Range Forecasting of the Anomalies of the Air Vertical Velocity Over the Northern Hemisphere.** Proposes a method of hydrodynamic long-term prognosis (using contemporary aerological data) of average vertical points for the entire Northern hemisphere. (*In Russian.*) O dolgosrochnom prognoze anomalii vertikal'nykh skorosteĭ dvizheniia vozdukha nad severnym polushariem zemli. ***Sh. A. Musaelian.*** *Akademiia Nauk SSSR, Doklady*, v. 137, no. 1, Mar.-Apr. 1961, p. 72-75.

* **Surveying the Deep-Sea Floor With Cameras.** ***Carl J. Shipek.*** *Photogrammetric Engineering*, v. 27, no. 1, Mar. 1961, p. 84-91.

* **Large-Scale Electron Bombardment of the Atmosphere at the Sudden Commencement of a Geomagnetic Storm.** The electron bombardment of the upper atmosphere that gave rise to the X-rays occurred on a large scale, ionospheric absorption coincident with the X-ray burst being observed by riometers in Alaska, Sweden, and Norway. ***R. R. Brown, et al.*** *Journal of Geophysical Research*, v. 66, no. 4, Apr. 1961, p. 1035-1041.

Underwater Acoustics Handbook. ***Vernon M. Albers.*** 290 pp. 1960. Pennsylvania State University Press, University Park, Penna. (QC225 AL14u)

Generation of Electric Charge Associated With the Formation of Soft Hail in Thunderclouds. Found that the sign of the charging is governed by that of the temperature

difference, the hailstone becoming negatively charged if it is warmer than the rebounding crystals. ***J. Latham and B. J. Mason.*** *Royal Society, Proceedings*, v. 260, ser. A, Mar. 21, 1961, p. 537-549.

* **Meteorite Analysis: The Search for Diamond.** No diamonds were found in seventeen meteorites using the methods described. ***D. V. N. Sarma and T. Mayeda.*** *Geochimica et Cosmochimica Acta*, v. 22, nos. 2-4, Mar. 1961, p. 169-175.

* **Radioactive Species Produced by Cosmic Rays in Iron Meteorites.** The radioactive isotopes Be^{10}, Al^{26}, Cl^{36}, K^{40}, and Mn^{53} have been measured in four iron meteorites. ***M. Honda, J. P. Shedlovsky, and J. R. Arnold.*** *Geochimica et Cosmochimica Acta*, v. 22, nos. 2-4, Mar. 1961, p. 133-154.

Water on the Moon? A re-examination of this question indicates the generally accepted answer may be wrong. A closer study of the surface, particularly near the poles, is now in order. ***Zdeněk Kopal.*** *Discovery*, v. 22, Apr. 1961, p. 143-146.

* **Advancing Fronts in Meteorology.** ***Graham Sutton.*** *Contemporary Physics*, v. 2, no. 3, Feb. 1961, p. 165-182.

* **On the Seasonal Variation in Lunar and Solar Geomagnetic Tides in the Geomagnetic Equatorial Region.** ***K. S. Raja Rao.*** *Journal of Atmospheric and Terrestrial Physics*, v. 20, no. 4, Apr. 1961, p. 289-294.

* **The Murray Deposit, Restigouche County, N. B. A Geochemical-Geophysical Discovery.** Describes a massive copper sulfide deposit. ***H. W. Fleming.*** *Canadian Mining and Metallurgical Bulletin*, v. 54, no. 587, Mar. 1961, p. 230-235.

Extra-Terrestrial Life. Explains why Mars and Venus are the only possible candidates. ***Philip H. Abelson.*** *National Academy of Sciences, Proceedings*, v. 47, Apr. 1961, p. 575-581.

Physics of the Upper Atmosphere. For those not working on the physics of the upper atmosphere the book as a whole will provide a survey of this part of physics which has made rapid advances in recent years. ***J. A. Ratcliffe, editor.*** 586 pp. 1960. Academic Press, New York. (QC879 R18p)

Seasonal, Latitudinal and Diurnal Variations in the Upper Atmosphere. Results from some 30 vertical sounding rockets carrying the grenade experiment show that over the latitude-altitude ranges sampled, the winds are strong and from the west during the winter months; weak and from the east during the summer months. The measurements made at the seasonal turnovers particularly reveal the nature of the circulation pattern. ***William G. Stroud and William Nordberg.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-703, Apr. 1961, 16 pp. (TL570 Un3t Vis.)

Separation Engineering on the Moon. Describes the manifold problems in separation engineering that would be encountered by men when they land and work on the moon. Concludes that almost the only place where operations on the moon would offer an advantage compared to terrestrial conditions is in the case of the refining of nonvolatile metals for which vacuum removal of impurities is mandatory. On the moon, solar heating of the melted metal, with appropriate stirring should be sufficient to provide a quality product. ***A. M. Gaudin.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 221, no. 2, Apr. 1961, p. 210-218.

* **Long-Range Sound Propagation in the Deep Ocean.** The propagation is quantitatively predictable, and quite stable. Convergence of acoustic energy along caustics results in losses smaller by about 20 db than those encountered in a free field. ***F. E. Hale.*** *Acoustical Society of America, Journal*, v. 33, Apr. 1961, p. 456-464.

Sandia Corporation Research Colloquium. Solid Interplanetary Matter. In contrast to the comets and other larger objects in the solar system, this matter cannot maintain a steady orbit about the sun. The relativistic aberration of solar light pressure causes it to spiral slowly into the sun where it disappears due to evaporation and sputtering by the solar cor-

puscular radiation. A constant flux of dust towards the sun results. ***David Beard.*** *U. S. Atomic Energy Commission,* SCR-252, Jan. 1961, 22 pp.

* **The Evaluation of Vertical-Lift Performance in Producing Wells.** Flowing and gas-lift well-performance characteristics are determined from available well-test data. The effect of tubing size, gas-liquid ratio and well-head pressure is discussed for both flowing and gas-lift wells. The effect of gas-injection pressure, formation gas, bottom-hole pressure and valve spacing is also discussed for gas-lift wells. ***R. V. McAfee.*** *Journal of Petroleum Technology,* v. 13, Apr. 1961, p. 390-398.

* **Field Results of Miscible-Displacement Program Using Liquid Propane Driven by Gas, Parks Field Unit, Midland County, Texas.** A total of 1,540,000 bbl of liquid propane was injected into 23 wells between June 1957, and July 1958. During July 1958, residue gas injection was begun at an injection rate of approximately 10 MMcf/D. Gas has been injected at this rate to the present time, and cumulative gas injection to July 1, 1960, has totaled 6,871 MMcf. It is concluded at this time that the project can be declared an engineering success. ***Doyle G. Marrs.*** *Journal of the Petroleum Technology,* v. 13, Apr. 1961, p. 327-332.

Cumulus Dynamics. Contains some 20 papers, the proceedings of the First Conference on Cumulus Convection, sponsored by the Geophysics Research Directorate of the U.S. Air Force Cambridge Research Center, and held at Portsmouth, New Hampshire. Covered the pre-cloud and sub-cloud phenomena and dealt with actual observations in the field of temperature, moisture, and flow involved in actual cumulus clouds or their laboratory counterparts. ***Charles E. Anderson, editor.*** 211 pp. 1960. Pergamon Press, New York. (QC921 C76c)

* **Excitation of Helium in the Aurora.** Because of the present inadequate knowledge of He cross-sections, the calculations are only an exploratory approach toward the problem of He in aurorae. ***J. M. Malville.*** *Journal of Atmospheric and Terrestrial Physics,* v. 21, no. 1, Apr. 1961, p. 54-64.

* **First Results of IGY Rocket and Satellite Research.** Some 60 papers which were presented in Moscow in Aug. 1958. ***Homer E. Newell, Jr. and Leonard N. Cormier, editors.*** *Annals of the International Geophysical Year,* v. 12, pt. 2, 1961, 475 pp.

* **Nephelometric Measurement Method of the Transparency of Atmosphere.** Review. (*In Russian.*) O nefelometricheskom metode iz mereniia prozraehnosti atmosfery. ***O. D. Barteneva and G. Ia. Bashilov.*** *Akademiia Nauk SSSR, Izvestiia, Seriia Geofizicheskaia,* 1961, no. 4, Apr., p. 613-619.

* **Some Peculiarities of Scandium Concentration.** The geological environment is characterized in which Sc concentration in deposits of definite genetic types is taking place. It is noted that Sc concentrates in geochemical provinces of two types. The introduction of ore-bearing granite intrusions into aluminosilicate rocks is favorable to the formation of Sc-bearing deposits, especially under conditions of rock-assimilation by the granite magma. (*In Russian.*) Nekotorye osobennosti kontsentratsii skandiia. ***A. D. Kalenov.*** *Geokhimiia,* 1961, no. 3, p. 243-251.

Radio Emission From the Planets. ***F. D. Drake.*** *Physics Today,* v. 14, Apr. 1961, p. 30-34.

Physics and Archaeology. Explains some of the ways in which physics has been applied to archaeology. It is intended both for the general scientific reader and for the student of archaeometry—measurements made on archaeological material. The physicist is asked to help in the areas of magnetic location and resistivity surveying. Emphasis is on methods which produce objective, quantitative results. ***M. J. Aitken.*** 181 pp. 1961. Interscience Publishers, New York. (CC75 Ai93p)

* **Variable Conditions of the Terrestrial Exosphere.** Three effects seem to be of more influence than seasonal and latitudinal variations, at least up to 60° latitude. ***H. K. Paetzold and H. Zschörner.*** *Astronautica Acta,* v. 6, no. 6, 1960, p. 373-381.

* **Element Distribution Laws in Geochemistry.** Attempts to reconcile some of the different points of view in a difficult field, and to show that most authors have been guilty of over-simplification and over-generalization. Most of the points of criticism against the lognormal law of Ahrens indicate the problems encountered in selecting *any* law. ***D. M. Shaw.*** *Geochimica et Cosmochimica Acta,* v. 23, nos. 1-2, Apr. 1961, p. 116-134.

* **Lunar Features and Lunar Problems.** The major features of the Moon (mares, highlands, craters, fractures) are briefly reviewed. Special attention is given the fracture systems, the origin of the lava filling many closed craters, and the origin of the central peak complexes. ***L. W. LeRoy.*** *Geological Society of America, Bulletin,* v. 72, Apr. 1961, p. 591-603 + 2 plates.

How the Soils Engineer Can Help the Mill Man in the Construction of Proper Tailings Dams. The soils engineer can combine theoretical soil mechanics—with emphasis on the concept of effective stress—and practical earthwork engineering to obtain this crucial result: safety factors for embankment stability. With the right data from the mine operator, the soils engineer can analyze existing embankments and examine prospective disposal areas. ***Bruce N. Mac Iver.*** *Engineering Journal,* v. 162, May 1961, p. 85-90.

* **Geothermal Gradients Now Known in Greater Detail.** Reliable temperature-depth ratio coverage is being extended. ***P. L. Moses.*** *World Oil,* v. 152, May 1961, p. 79-82.

Density of the Lunar Atmosphere. The consequences of a model are worked out in which the lunar atmosphere is formed by gravitational accretion of interplanetary gas. ***E. J. Öpik and S. F. Singer.*** *Science,* v. 133, May 5, 1961, p. 1419-1420.

* **Space Research.** Considers what is meant by space research, what it entails, and what we may reasonably hope to learn from it. Particular attention is paid to distinguishing the roles of the two principal space vehicles, vertical sounding rockets and satellites. ***Harrie Massey.*** *Endeavour,* v. 20, no. 78, Apr. 1961, p. 68-77.

* **Spectrum of a Discrete Source of Cosmic Radiation of Cassopeia A at the Frequencies Below 30 Mc/sec.** Radiation density was measured with a wide range interferometric radiotelescope for frequencies from 31 to 19.5 megacycles per second. (*In Ukrainian.*) Spektr dyskretnogo dzherela kosmichnogo radiovyprominiuvannia kassiopeyi a na chastotakh nyzhche 30 Mgc. ***S. Ia. Braude, A. V. Men', I. M. Zhuk, and K. A. Babenkov.*** *Akademiia Nauk Ukraïns'koï RSR, Dopovidi,* 1961, no. 4, p. 469-472.

* **Dustless Breaking of Rocks Electrically.** Methods of imposing electric currents; ore lumps weighing up to 15 tons broken; cheaper than secondary blasting; disadvantages of method noted. ***V. S. Kravchenko, A. P. Obrastsov, and V. V. Ustinov.*** *Mining Congress Journal,* v. 47, May 1961, p. 53-55.

The Mohole Experiment. Drilling trials have begun near Guadalupe Island off the Mexican coast. Benefits to knowledge which the Mohole may yield are discussed. ***Tom Gaskell.*** *New Scientist,* v. 10, Apr. 13, 1961, p. 20-23.

* **The Investigations on the Possibility of Recovery of Other Precious Metals Occurring Together With Uranium in Ores.** Method permits a decrease in the production costs of the sodium diuranate and shows the recovery possibility of other precious metals. (*In Polish.*) Badania możliwości uzyskania metali towarzyszących uranowi w rudach. ***Karol Pinkas.*** *Nukleonika,* v. 6, no. 2, 1961, p. 127-133.

GRAPHIC ARTS

* **An Encyclopedia of the Book.** Terms used in papermaking, printing, bookbinding and publishing with notes on illuminated manuscripts, bibliophiles, private presses and printing societies. ***Geoffrey Ashall Glaister.*** 484 pp. 1960. World Publishing Co., New York. (Z118 G45e Ref.)

Faster Photo-Drawings. A simple technique combining two-minute slides, projection, and a diazo set-up. ***Clayton B. Hammond.*** *Graphic Science,* v. 3, Apr. 1961, p. 22-24.

* **Present and Future Capability of Optical Systems With Emphasis on the Ballistic Camera Operation.** Description, operation, and accuracy of the three basic optical instrumentation systems in use at the Air Force Missile Test Center for obtaining missile trajectory information are discussed. ***George H. Rosenfield.*** *Photogrammetric Engineering*, v. 27, no. 1, Mar. 1961, p. 51-55.

* **A Satellite's View of the Earth.** Distortions not encountered in conventional aerial photography are presented and remedial measures are proposed. ***Leo V. Strees.*** *Photogrammetric Engineering*, v. 27, no. 1, Mar. 1961, p. 37-41.

* **A "Sky Lens" for an Auroral Spectrograph.** ***N. J. Rumsey.*** *Optica Acta*, v. 8, no. 1, Jan. 1961, p. 17-19.

* **Latensification of Negative Emulsions.** By desensitizing an exposed emulsion before applying a low intensity post exposure, the latensification is enhanced because of the insensitivity of those grains not originally exposed. ***A. Hautot.*** *Journal of Photographic Science*, v. 9, no. 2, Mar.-Apr. 1961, p. 101-105.

* **How Many Quanta?** A method for disentangling the effect of random quantum fluctuations, to find the proportion of grains which, under the given conditions, were rendered developable by the various integral numbers of quanta is presented. ***A. Marriage.*** *Journal of Photographic Science*, v. 9, no. 2, Mar.-Apr. 1961, p. 93-100.

* **Elementary Photographic Processes in the Electric Field.** Effect of electric fields on photographic emulsions. (*In Russian.*) Elementarnye fotograficheskie protsessy velectricheskom pole. ***A. L. Kartuzhanskii.*** *Uspekhi Fizicheskikh Nauk*, v. 73, no. 3, Mar. 1961, p. 471-502.

* **Correlation Between Random-Dot Samples and the Photographic Emulsion.** Expressions for density, root-mean-square density deviation, and Selwyn granularity are derived on the basis of a model. Samples produced by this method are shown experimentally to conform to the expected properties. ***J. C. Marchant and P. L. P. Dillon.*** *Optical Society of America, Journal*, v. 51, June 1961, p. 641-644.

HUMAN FACTORS

* **Operational Sequence Diagrams in System Design.** The Operational Sequence Diagram is a type of process chart modified for the peculiar needs of human factors work. Its primary use has been in determining man-machine interaction sequences, in analyzing communication requirements between groups of men and machines, and in coordinating information-decision-action sequences between interfacing subsystems. ***Martin I. Kurke.*** *Human Factors*, v. 3, no. 1, Mar. 1961, p. 66-73.

* **Some Immediate Effects of Drowsiness and Sleep on Normal Human Performance.** Reviews the experimental literature describing normal human performance at different levels of drowsiness and sleep, as these states are defined by electroencephalographic patterns. Among the types of behavioral responses to stimuli discussed are reflexes, simple movements, detection (i.e. arousal to external stimuli and awareness of internal states), discrimination, learning, and recall. Nonbehavioral electroencephalographic responses are also described. ***Charles W. Simon.*** *Human Factors*, v. 3, no. 1, Mar. 1961, p. 1-17.

* **An Experimental Investigation of the Interaction Between Problem Load and Level of Training.** An experiment was made to determine the function which describes the relation between performance and problem load. Analysis of the total errors indicated that performance is a linear function of the magnitude of load. ***Richard A. Behan, Charles R. Bughman, James N. Bumpus, and Sally Gilbert.*** *Human Factors*, v. 3, no. 1, Mar. 1961, p. 53-59.

* **A Technique for Evaluating Man-Machine System Designs.** A computer-based method for digitally simulating the performance, in one-operator systems, of operators who possess various characteristics is described. The method is believed applicable for evaluating various system designs while the system is in the early design stage. Two operational tasks, landing an F4D aircraft on a carrier and firing an air-to-air missile, were simulated using the method. The predictions from the model were compared with outside criterion data for the same tasks. The predictions are held to conform generally with reality and to be reasonable. The results of the two applications of the model were in general agreement. ***Arthur I. Siegel and J. Jay Wolf.*** *Human Factors*, v. 3, no. 1, Mar. 1961, p. 18-28 + 1 plate.

* **Human Engineering in Safety.** Industry needs: a better work-simplification program, improved machine design to assure better maneuverability, and better working conditions for the operator, more attention to mining plans, exhaustive research in roof control for the protection of personnel and for higher mining efficiency. ***C. G. Evans.*** *Mining Congress Journal*, v. 47, May 1961, p. 69-71.

INFORMATION RESEARCH

* **Planning the New Library: Hughes Aircraft Company's Ground Systems Group Technical Library.** Author's experience in setting up a technical library including layout, personnel, cataloging, etc. ***Doris H. Banks.*** *Special Libraries*, v. 52, no. 4, Apr. 1961, p. 191-197.

* **Simultaneous Preparation of Library Catalogs for Manual and Machine Applications.** The process described can be used by any organization possessing the most rudimentary machine equipment. It requires only a keypunch, a sorter, a reproducing punch, a printer and an interpreter—all relatively simple and inexpensive machines already in use for accounting and other data processing functions. ***Robert E. Durkin and Herbert S. White.*** *Special Libraries*, v. 52, no. 5, May-June 1961, p. 231-237.

* **Automation Raps at the Door of the Library Catalog.** The printed catalog produced by means of automatic equipment combines the best features of the conventional card catalog and the traditional printed catalog, and adds to both new dimensions that would have been unbelievable a generation ago. ***Charles A. Vertanes.*** *Special Libraries*, v. 52, no. 5, May-June 1961, p. 237-242.

New Information Retrieval Standards. A handy, standardized way to index magazine articles, books and company reports has been proposed by AIChE's Standards Committee. ***Rollin Morse and Eugene Wall.*** *Petroleum Refiner*, v. 40, May 1961, p. 263-265.

Teaching Machines. Reviews the work being done and the future of teaching machines. ***John Annett, Harry Kay, and Max Sime.*** *Discovery*, v. 22, May 1961, p. 191-198.

The Information Explosion. Discusses problems created by the ever-increasing amount of scientific information published each year. ***Lawrence W. Ross.*** *Research Engineer*, v. 16, no. 2, Apr. 1961, p. 5-7.

Machine Translation. Reviews some of the work being done and some of the problems encountered. ***Robert W. Hays.*** *Research Engineer*, v. 16, no. 2, Apr. 1961, p. 16-20.

Technical Information Services. Discusses the type of information searches, particularly those done at Georgia Tech. ***Lawrence W. Ross and Robert J. Kyle.*** *Research Engineer*, v. 16, no. 2, Apr. 1961, p. 21-23.

INSTRUMENTATION

* **Ultra-High Vacuum.** Ultra-high vacuum is generally taken to apply to pressures less than 10^{-11} atmospheres. In recent years, the attainment of vacua of this kind has become increasingly necessary, and commercial equipment has been developed. ***G. Lewin.*** *Endeavour*, v. 20, no. 78, Apr. 1961, p. 85-91.

Millimicrosecond Light Source With Increased Brightness. The current density in the arc channel, ~0.1 mm in diameter, exceeds 10^7 amp/cm^2; arc channels appear to be pinched. ***Heinz Fischer.*** *Optical Society of America, Journal*, v. 51, May 1961, p. 543-547.

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* **Leak-Detection Techniques.** Shows that a mass spectrometer is superior to a bubble test in various ways—the criteria for failure is set electronically and not left to the discretion of the operator, the sensitivity of a mass spectrometer is much greater than that of a bubble test, and the mass spectrometer can be set up to perform the leak tests automatically. The major drawback to this method is the expense. Concludes that additional work should be done in standardizing leak tests throughout industry. ***H. S. Scheffler and Eugene N. Wyler.*** *Military Systems Design*, v. 5, no. 2, Mar.-Apr. 1961, p. 30-32.

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Observing Living Specimens With the Electron Microscope. Shows a solution to the difficult problem of using an electron microscope at exceptionally high voltages. ***G. Dupouy, F. Perrier, and L. Durrieu.*** *Discovery*, v. 22, Apr. 1961, p. 161-164.

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A Hydrogen Condensation Pump With a Built-In Liquefier. Describes a pump which has its own liquifier. The limiting vacuum is 10^{-8}-10^{-9} mm Hg. ***E. S. Borovik, B. G. Lazarev, and I. F. Mikhailov.*** *Reactor Science*, v. 13, nos. 3-4, Jan. 1961, p. 194-197.

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A Reader for Hand-Marked Documents. A design is described for a simple machine to read hand-marked documents such as invoices. ***Cynthia M. B. Reid.*** *Electronic Engineering*, v. 33, May 1961, p. 274-278.

e

A Torquemeter for Milling Investigations. A differential transformer type of transducer is employed and an output signal suitable for operating a pen recorder or for display on an oscilloscope is provided. ***J. L. Gwyther.*** *Electronic Engineering*, v. 33, May 1961, p. 292-295.

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Industrial Research. Pertains to basic application of light microscopy. Parts of the entry include: resolving limit, useful magnification, and contrast; alignment, and related methods of illumination; approach to the problem and applications; and the initial necessity of correct specimen preparation. ***C. W. Melton and C. M. Schwartz.*** Paper from "The Encyclopedia of Microscopy", p. 363-381, 1961. Reinhold Publishing Corp., New York. (QH205 C54e)

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The Encyclopedia of Microscopy. Surveys the broad field of microscopy in over 140 specially written articles covering the biological, medical, pharmaceutical, forensic, chemical, engineering and industrial applications. ***George L. Clark, editor.*** 693 pp. 1961. Reinhold Publishing Corp., New York. (QH205 C54e)

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Temperature Measurement by Filled System. Filled-system thermometers use temperature-induced liquid or gas expansion effects. Desired range and application determines the filling media, which can be Hg, gas, liquid, or vapor. ***Robert C. Nelson.*** *Instruments and Control Systems*, v. 34, May 1961, p. 849-853.

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Bimetal Thermometers. Bimetal thermometers feature simplicity, ruggedness and economy. The author describes their principles, features, application, response, and accuracy characteristics. ***E. R. Kebbon.*** *Instruments and Control Systems*, v. 34, May 1961, p. 841-845.

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LUBRICATION AND FRICTION

* **The Lubrication Requirement of Nuclear Powered Surface Vessels—Design Considerations.** Considers the effect of nuclear surface-vessel design on the functional requirements of lubricants. The critical design features of potential nuclear surface propulsion systems are reviewed to determine the physical requirements imposed on the lubricant by the total environment, radiation being only one of the many factors to be considered. Indicates that the lubrication problems of nuclear propelled ships are similar to those of their conventional fossil-fueled

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counterparts. Radiation stress, the main new environmental feature, is a consideration only in those components which are associated with the nuclear heat source (control rods, etc.), and then it is generally not a controlling consideration. The lubricants for the propulsion gear and its auxiliary systems present no new lubrication problems. However, leakage and primary coolant contamination requirements often take precedence in the selection of the lubricant or lubrication system. ***E. H. Okrent.*** *Lubrication Engineering*, v. 17, May 1961, p. 218-225.

The Load Capacity of Gear Teeth Along the Line of Action. The hydrodynamic lubrication of involute spur gears is analyzed for an arbitrary point of contact along the line of action. The actual involute tooth shape and squeeze effects are taken into account. Results are presented for the pressure distribution and load capacity. It is found that the maximum load capacity does not occur at the pitch point. ***R. R. Stephenson and J. F. Osterle.*** *Wear*, v. 4, no. 1, Jan.-Feb. 1961, p. 56-63.

The Effect of Lubricant Viscosity on the Lubrication of Gear Teeth. Deals with the measurement of oil-film thickness between lubricated contacting surfaces under load. The ability to measure oil-film thickness, in this case on gear teeth, may lead to a better future understanding of the best lubricant and tooth contour to be used for any given set of operating conditions for the reduction of wear. ***Ian O. MacConochie and Walter H. Newman, Jr.*** *Wear*, v. 4, no. 1, Jan.-Feb. 1961, p. 10-21.

MECHANICAL ENGINEERING

Value...The Emerging Emphasis in Design. A study of present and future potentialities of specialist services in design engineering—reliability, value analysis, value engineering, quality assurance and the like, based on interviews with and comments from some 80 men, many of them engineering executives. ***E. J. Tangerman.*** *Product Engineering*, v. 32, no. 20, May 15, 1961, p. 79-94.

* **On the Stability of a Gimbal Mounted Gyroscope.** The combination of large gimbal frame inertia with slackness in the main rotor bearings can result in a gyroscope executing self-excited oscillations. Such a gyroscope can be simulated by a model which reproduces the main features of this instability. As a first step toward a full analysis of this behavior a stability criteria for the model is established. ***J. M. Prentis.*** *Journal of Mechanical Engineering Science*, v. 3, no. 1, Mar. 1961, p. 1-6.

Gyro Damping. Its Part in Platform Design. Gyro precession axis damping was found to have a twofold effect: for loop stability, it should be large; to prevent the transmission of aircraft oscillations, it should be small. Investigation disclosed a simple method of determining quantitatively the optimal values of the parameters of a platform provided with single-degree-of-freedom rate-integrating gyros. ***E. M. Fischel.*** *Aero/Space Engineering*, v. 20, May 1961, p. 16 + 9 pages.

METALLURGY

* **Recent Data on the Development of the Chinese Metallurgical Industry.** Chinese metallurgy has made substantial progress during the last few years. The author analyzes a few items of information which can be considered sufficiently reliable. There are large reserves of most essential ores in China. (*In French.*) Données récentes sur le développement de la métallurgie chinoise. ***Pierre Arnold.*** *Métallurgie et la Construction Mécanique*, v. 93, Mar. 1961, p. 171 + 2 pages.

History of the Science and Technology of Aluminum and Its Industrial Development. Volume I covers the period from 1800 to 1945 and is essentially historical in its treatment. The author deals first with the researches of four pioneers: Davy, in 1808; Oersted, in 1825; Wöhler, in 1827 and 1845; and Bunsen, in 1852 and 1854. Passing to a study of the early industrial processes, the book deals, in particular, with the works of Henri Sainte-Claire Deville, Bradley and Hall, Héroult, and Kiliani. The period of technological expansion, beginning

about 1945, is the subject of Volume II. (*In French.*) Historie de la Science et des Techniques de l'aluminium et ses développements industriels. ***L. Ferrand.*** v. I-II. 1244 pp. 1959. Published by the author, depository: Journal du Four Électrique, 86 rue Cardinet, Paris (17e).

* **Niobium, an Atomic Metal: Metallurgy and Uses.** Definition of this metal and its properties; processing; new alloys with an extra-pure Nb base. Uses. (*In French.*) Le niobium, métal atomique: métallurgie et applications. *Métallurgie et la Construction Mécanique,* v. 93, Mar. 1961, p. 177 + 7 pages.

* **Molybdenum Pig Iron: New Uses.** Molybdenum increases the tensile and impact strength of pig iron. Metallographic considerations. Properties and uses of grey, white or malleable molybdenum pig iron. (*In French.*) Les fontes au molybdène: applications nouvelles. *Métallurgie et la Construction Mécanique,* v. 93, Mar. 1961, p. 191 + 7 pages.

Rare Metals Handbook. Compiled by 44 experts, this handbook presents the full range of currently available data on 55 of the less-common metals. Six essentially new metals are added to those covered in the first edition, viz., cesium, chromium, rubidium, scandium and yttrium, as well as columbium and tantalum. ***Clifford A. Hampel, editor.*** 2nd Ed. 715 pp. 1961. Reinhold Publishing Corp., New York. (QD172.R2 H18r2)

Columbium. The metallurgical aspects of this metal, viz., sources; separation of columbium from tantalum; extractive metallurgy; consolidation and purification; physical properties; mechanical and chemical properties; analysis; metallography; metal working, fabrication, and cutting; cleaning; electroplating; welding; and applications are discussed. Presents a bibliography of 150 entries. ***Edwin M. Sherwood.*** Paper from "Rare Metals Handbook", 2nd Ed. p. 149-177. 1961. Reinhold Publishing Corp., New York. (AD172.R2 H18r2)

* **The Effects of Copper on the Corrosion Behavior and the Mechanical Properties of Chromium-Nickel Steels.** The effects of Cu on the corrosion resistance, the hardening behavior, some mechanical properties, the deformability and weldability of ferritic-austenitic steels with about 28% Cr and 4% Ni, and of austenitic steels with about 18% Cr and 8% Ni were examined. (*In German.*) Der Einfluss von Kupfer auf das Korrosionsverhalten und die mechanischen Eigenschaften von Chrom-Nickel-Stählen. ***Thonnangamath Ramchandran, Karl Roesch, and Hans-Jürgen Engell.*** *Archiv für das Eisenhüttenwesen,* v. 32, no. 3, Mar. 1961, p. 173-185.

Recent Developments in Titanium. Survey of markets, chemical reactions, mechanical properties, status of new high-strength alloys, and fabrication of titanium. ***R. A. Wood.*** *Light Metal Age,* v. 19, Apr. 1961, p. 6 + 1 page.

Titanium. The metallurgical properties of this "new" material of construction, viz., occurrence; production; extractive metallurgy; physical and mechanical properties; chemical properties; physical metallurgy; processing and fabrication; and applications of titanium are discussed. ***H. R. Ogden.*** Paper from "Rare Metals Handbook", 2nd Ed., p. 559-579. 1961. Reinhold Publishing Corp., New York. (AD172.R2 H18r2)

METALS—CORROSION

* **Stress-Corrosion Tests With Anodic Current on Al-Mg Alloys.** A new test has been developed, based on anodic current, which can be successfully used for a quick determination of stress-corrosion of Al-Mg alloys. (*In Italian.*) Prove di tensocorrosione con corrente anodica impressa su leghe *Al-Mg.* ***Anna Prati.*** *Chimica e l'Industria,* v. 43, Apr. 1961, p. 381-389.

Causes and Cures for Cooling Water Corrosion Problems. Oxygen, pH, temperature, velocity, water consumption and other variables discussed in this general review. ***A. J. Freedman and D. B. Boies.*** *Petroleum Refiner,* v. 40, Apr. 1961, p. 157-162.

Reaction of Copper and Fluorine From 800° to 1200° F. The reaction of copper foil and gaseous fluorine was studied in an all-glass apparatus at a pressure of about 200 millimeters

mercury and temperatures from 800 to 1200 F. The reaction rate varied with pre-run sample treatment, temperature, and time. It was observed that the higher the preheat temperature the lower the fluorine consumption. The reaction was controlled by a diffusion process through a solid barrier. ***Patricia M. O'Donnell and Adolph E. Spakowski.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN-D-768,* Apr. 1961, 15 pp. (TL570 Un3t Room 290)

Evaluation of Structural Materials for Corrosion Resistance. An article describing various forms of corrosion tests with illustrations of the specimens used. ***R. James Landrum.*** *Metals Engineering Quarterly,* v. 1, no. 2, May 1961, p. 45-57.

Metallic Corrosion Inhibitors. Reviews the theoretical and practical aspects of the application of corrosion inhibitors. Deals with the classification of inhibitors; examples of synergism and antagonism, the effects of temperature, movement of the medium, etc.; the theories advanced to explain the mechanism of protective action, viz. the adsorption, the polarization, and the protective film theories. ***I. N. Putilova, S. A. Balezin, and V. P. Barannik.*** 194 pp. 1960. Pergamon Press, New York. (TA462 P98itr)

Growth of Single Iron Crystals for Corrosion Studies. A description is given of a laboratory method used to produce single iron crystals which have characteristic plane surfaces and essentially cubic dimensions. Such specimens are useful in corrosion studies where various crystallographic planes are of interest. ***Willard F. Brickell and Edward C. Greco.*** *Corrosion,* v. 17, May 1961, p. 115-116.

Development of a Mineral Scale Inhibitor. The expense attributable to scaling in oil producing operations totals many millions of dollars annually. Causes of precipitation and deposition are fairly well understood but better methods of control are needed. In order to evaluate chemical scale inhibitor components, a laboratory testing device was designed. Performance of sequestrants, surface active agents, colloids, and mixed compounds in the laboratory tester are discussed. ***L. W. Jones.*** *Corrosion,* v. 17, May 1961, p. 110-114.

* **Processes Occurring in the Metal-Oxide Interphase During the High Temperature Oxidation of Cobalt.** During the oxidation of metallic Co between 400 and 1424 C, the Co oxide exhibits a fine grain structure between the metal and the large crystals of basalt type formed by the rest of the Co oxide. Four hypotheses are presented to explain the process; they are based individually on coefficients of expansion, accumulation of impurities, difference in the crystal lattices, diffusion of the ions of the metal and of O_2. (*In Portuguese.*) Fenômenos na interfase metal-óxido durante a oxidação alta temperatura do cobalto. ***David Fuller Brain and Hernán Suárez Suárez.*** *ABM (Boletim da Associação Brasileira de Metais),* v. 17, no. 63, Mar. 1961, p. 195-204.

Predict Furnace-Tube Corrosion Rate. With these correlations for distillation-unit furnace tubes in sour-crude service, Shell was able to predict tube life. The method should apply to any distilling unit. ***G. R. Port.*** *Oil and Gas Journal,* v. 59, no. 20, May 15, 1961, p. 155 + 2 pages.

* **The Stress-Cracking of Brass.** A comprehensive review with 186 references covering: the cracking of brass in ammonia and other media, including studies of the mechanism, the fracture characteristics of brass in the impact test, intercrystalline cracking of β-brasses under sustained tensile stress, cracking in contact with molten metals, fire-cracking, and protection against stress-corrosion cracking. ***A. R. Bailey.*** *Metallurgical Reviews,* v. 6, no. 21, 1961, p. 101-142 + 4 plates.

Properties of Lithium Hydride II, Lithium Hydride Corrosion Studies: 19-9DL Alloy. 19-9DL Alloy sheet (AMS5526) specimens (unwelded and welded) were tested for short-time tensile properties after 65 and 100 hours exposure to molten lithium hydride at 1325 F and 1425 F, respectively. Metallographic examination revealed negligible corrosion by the molten lithium hydride. Weight loss tests and chemical analyses confirmed the metallographic results. For comparison, preliminary test data on other 300 series stainless steels (Types 301, 304, 316, 316 ELC, 317, 318, 321 and 347) exposed to molten LiH under similar conditions are included. In general, similar behavior is encountered. ***Frank H. Welch.*** *U. S. Atomic Energy Commission, APEX-586,* Apr. 10, 1961, 41 pp. (UF767 Un3.1ap Contin.)

* **Suppression of Steel Corrosion in Wet Grinding Mills.** Steel losses per ton of material ground are generally much higher in wet-grinding raw mills than in dry-grinding raw or cement mills. This difference is thought to be due to corrosion of steel. Experiments have shown that these losses can be reduced considerably by raising the pH of the slurry. Under suitable conditions continuous addition and remixing of precipitated kiln dust with raw slurry at the raw mill will add enough alkali to suppress corrosion and at the same time effectively return dust to the production system. ***Vincenza Anderlini and H. E. Vivian.*** *Australian Journal of Applied Science,* v. 12, no. 1, Mar. 1961, p. 87-95.

* **Investigations of Oxidation Processes of Nickel-Chrome-Alloys Used in Heating Elements.** Alloys with 80 wt.% Ni and 20 wt.% Cr were used for oxidation tests. It has been found that oxidation rate and adherence of the oxide layer can be considerably influenced by additions of cerium, calcium or the oxides of these elements. The durability of a heating conductor wire depends mainly on the adherence of an oxide layer. The effect of the above-mentioned alloying elements is discussed. (*In German.*) Untersuchungen über Oxydationsvorgänge an Nickel-Chrom-Heizleiter-Legierungen. ***Volker Schumacher.*** *Zeitschrift für Metallkunde,* v. 52, Apr. 1961, p. 280-284.

Diffusion in Solids and the Gaseous Corrosion of Metals. Background-type article, describes Wagner's theory for diffusion-controlled reaction and a recent proof of this theory. ***Walter J. Moore.*** *Journal of Chemical Education,* v. 38, May 1961, p. 232-238.

* **Electrochemical Techniques in Stress-Corrosion Cracking.** Examples of the application of electrochemical methods to the investigation of stress-corrosion cracking and related phenomena in light alloys, stainless and other alloy steels, and brass (including some preliminary new results), are given. One of several papers in this issue devoted to stress corrosion. ***T. P. Hoar.*** *TVF. Teknisk-Vetenskaplig Forskning,* v. 32, no. 3, 1961, p. 93-103.

* **The Metal Physics of Stress Corrosion.** This paper deals principally with the formation and propagation of cracks in single crystals or large-grained polycrystals under conditions where stress corrosion is known to occur. A model for stress corrosion based on a two-stage process of embrittlement followed by brittle crack propagation is presented, and some experimental evidence supporting this model is described. The principal requirements of the model, that is the process of embrittlement by the corrosive environment and the ability of a brittle fracture to propagate through a f.c.c. alloy, are examined in the light of current ideas in metal physics. One of several papers in this issue devoted to stress corrosion. ***A. J. Forty.*** *TVF. Teknisk-Vetenskaplig Forskning,* v. 32, no. 3, 1961, p. 104-121.

* **Influence of the Chloride Ion Concentration on the Stress Corrosion of Stainless Steels at Different Temperatures.** The time to rupture has been drawn in a diagram as a function of the chloride ion concentration of the solution. It was found that under the given test conditions a threshold value of the chloride ion concentration was obtained which is applicable to all the metal chlorides examined. Supplementary investigations have been carried out comprising tests within the temperature range 100-300 C in autoclaves. At the higher temperatures cracking occurs at substantially lower chloride ion concentration than at 100 C. One of several papers in this issue devoted to stress corrosion. ***Stig Berg and Sture Henrikson.*** *TVF. Teknisk-Vetenskaplig Forskning,* v. 32, no. 3, 1961, p. 145-151.

Du Pont Uses Nitromethane to Halt Corrosion of Aerosol Cans. Corrosion, odor, and discoloration of aerosol containers and alcohol-based products found to be due to free radical reaction between trichlorofluoromethane and ethanol; acetaldehyde and HCl being formed. Addition of nitromethane solves these problems. *Chemical & Engineering News,* v. 39, no. 21, May 22, 1961, p. 39.

* **A Tracer Study of the Nickel-Sulphur System at High Temperatures.** The sulfurization of Ni at 600 C was investigated using radioactive S^{35}. The formation of NiS occurs exclusively as a result of the outward diffusion of metal atoms. ***Andrzej Brückman, Stanisław Mrowec, and Teodor Werber.*** *Nukleonika,* v. 6, no. 1, 1961, p. 17-21.

Effect of Copper on the Corrosion of High-Purity Aluminum in Hydrochloric Acid. Single-phase Al containing 0.0001 to 0.06% Cu was studied in strong acid, mainly through observations of H_2 evolution. The strong influence of Cu was exerted almost entirely through the imposition after a certain delay time of an autocatalytic localized-corrosion reaction. Additions of cupric ion to the acid produced lower accelerations. The significance of the quantity and distribution of Cu was discussed, and the implications for intergranular corrosion and neutral chloride pitting were indicated. ***M. Metzger, G. R. Ramagopal, and O. P. Arora.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 221, no. 2, Apr. 1961, p. 250-256.

The Rates of Formation and Structure of Oxide Films Formed on a Single Crystal of Iron. Between 250 and 550 C in O_2 pressures of 10 to 760 mm Hg, the relative oxide thicknesses formed per unit time on the (100), (111), (110), and (320), decreased in this order. ***J. Bruce Wagner, Jr., Kenneth R. Lawless, and Allan T. Gwathmey.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 221, no. 2, Apr. 1961, p. 257-261.

Motion Picture Studies of Columbium Oxidation. Visual observation of the oxidation of columbium shows that the protective behavior noted previously in gravimetric work in the early stages of the reaction below 600 C and throughout the reaction at 640 C is associated with an adherent oxide. The fact that the oxide is seen to move outward from the metal at temperatures from 550 to 935 C implies that the reaction takes place at the oxide-metal interface throughout this temperature range. ***W. T. Hicks.*** *American Institute of Mining, Metallurgical and Petroleum Engineers, Transactions, Metallurgical Society,* v. 221, no. 2, Apr. 1961, p. 218-220.

* **Pit Corrosion and Surface Film Formation on Lead.** Tests were carried out in order to clarify the electrochemical phenomena during the formation of surface films on lead. Galvanostatic as well as potentiostatic measurements were carried out in different solutions capable of forming surface films, and the results were compared with each other. The agreement was found to be good. By comparing the maximum and minimum values of the potentiostatic current density with the formation potentials, calculated from thermodynamic data, of different insoluble lead compounds, it is possible to draw conclusions concerning the nature of the surface film formations occurring at given potentials, and their reduction. (*In German.*) Lochfrass und Deckschichtenbildung an Blei. ***Edith-Luise Schmeling and Benno Röschenbleck.*** *Werkstoffe und Korrosion,* v. 12, Apr. 1961, p. 215-223.

* **High Temperature Corrosion by Strong Concentration of Hydrogen Sulfide Gas and Sulfur Vapor.** Corrosion by H_2S and sulfur vapor at 1200 C was observed in 1958 in one of the Lacq sulfur production furnaces, which subsequently had to be shut down. The characteristics of component materials and the working conditions are described. The nature of corrosion products was determined by chemical and X-ray analysis. Although differing in their morphologies, all the sulfides formed appear to have the formula $Fe_{1-x}S$ of hexagonal or monoclinic structure with an α-Fe phase in the less attacked layers. The causes of corrosion are given as well as the changes in the refractory lining developed in order to prevent any other destruction of the furnace jacket. (*In French.*) Corrosion a haute température par des gaz a forte concentration d'hydrogène sulfuré et de soufre. ***Ph. Marchessaux.*** *Institut Francais du Pétrole, Revue et Annales des Combustibles Liquides,* v. 16, Feb. 1961, p. 184-193.

* **Mechanism of Metal Oxidation at High Temperatures.** Investigations of the mechanism of sulfurization of Cu and Ag with the application of a radioactive isotope of sulfur 35 were carried out. The purpose of these investigations was to explain the role of diffusion of S played in the process of formation of a double-layer sulfide scale on these metals. These investigations were carried out in liquid S at 444 C. In the process of formation of a double-layer sulfide scale on Cu and Ag there does not occur an inward diffusion of S. The process of the scale formation occurs in accordance with the Wagner's theoretical model—exclusively by the outward diffusion of the metal, but the formation of a double-layer scale in this case is in relation with secondary processes occurring in the interior of the scale during its growth. (*In Polish.*) Mechanizm utleniania metali

w wysokich temperaturach. ***Stanisław Mrowec.*** *Archiwum Hutnictwa,* v. 6, no. 1, 1961, p. 61-82.

New Methods of Simulating Corrosive Plant Conditions in the Laboratory. Various laboratory testing devices developed for the reproduction of corrosive plant conditions are described with particular emphasis on heat transferring surfaces. An all-glass, pressurized, heat transferring test unit capable of giving corrosive data under five different heat conditions is described in detail. ***A. Orman Fisher.*** *Corrosion,* v. 17, May 1961, p. 93-99.

The Influence of Atmospheric Corrosion on the Fatigue Limit of Iron-0.5% Carbon. Iron-0.5% carbon was fatigued in air and in vacuum. The knee in the S-N curve at the fatigue limit occurred at about the same number of cycles in vacuum as in air but at a higher strain. Above this strain specimens lasted about ten times as long in vacuum as in air. Slip occurred in a similar manner above and below the fatigue limit and cracks formed in the slip bands in both cases. Below the fatigue limit the cracks grew a few microns long. ***N. J. Wadsworth.*** *Philosophical Magazine,* v. 6, ser. 8, Mar. 1961, p. 397-401.

METALS—EXTRACTION AND REFINING

* **Behavior of Minette Ore Sinter in the Blast Furnace.** Description of the experimental conditions. Development of a small-sized sinter with low loose weight and high oxidation degree. Experimental results obtained by using a burden containing 80 and 100% sinter. (*In German.*) Verhalten von Minettesinter im Hochofen. ***Rudolf Sandhöfer and Otto Becker.*** *Stahl und Eisen,* v. 81, no. 8, Apr. 13, 1961, p. 501-503.

* **Water Re-Cooling Equipment for Electric Melting Furnaces.** Types of re-cooling equipment, fan cooling, theory of re-cooling, and calculation of the necessary cooler capacity. (*In German.*) Wasserrückkühlanlagen für Elektro-Schmelzöfen. ***W. Fritsche.*** *Giesserei,* v. 48, no. 7, Apr. 6, 1961, p. 166-170.

Oxygen Steelmaking in the Ajax Furnace of the Appleby-Frodingham Steel Co. Operating cost (above materials cost) is down to an average of 68% of standard practice. It is planned to convert eight furnaces in total to this process with an increase in annual production of 700,000 tons. ***Albert Jackson.*** *Iron and Steel Engineer,* v. 38, Apr. 1961, p. 67-76.

The Pre-Refining of Blast-Furnace Iron and Development of the Brymbo Oxygen/Electric Steelmaking Process. Trials carried out in a small open-hearth furnace and electric furnace bowl indicated the type of vessel most suitable for this operation. ***Emrys Davies.*** *Iron and Steel Institute, Journal,* v. 197, pt. 4, Apr. 1961, p. 271-282.

Argon Casting for Improving Steel Quality. Shows that complete argon atmosphere protection of molten steel during ingot casting results in a 30-65% reduction in nonmetallic inclusions, a decrease of 3-24% in conditioning losses, and a preservation of the effects of vacuum treatment. ***M. F. Hoffman, P. G. Bailey, and R. L. W. Holmes.*** *Journal of Metals,* v. 13, May 1961, p. 345-349.

Application of Flow Research to Industrial Furnaces With Particular Emphasis on Soaking Pits. A review of the essential elements of fluid dynamics is given, and some examples of applications of flow phenomena in the industrial furnace are considered. ***Herbert Boenecke.*** *Iron and Steel Institute, Journal,* v. 197, pt. 4, Apr. 1961, p. 283-295.

Deoxidizing Steels by Vacuum. Tests show that steel deoxidized by vacuum (rather than with metallic deoxidizers such as Si and Al) will contain less gases and fewer inclusions. ***G. E. Danner and E. Dyble.*** *Metal Progress,* v. 79, no. 5, May 1961, p. 74-78.

Pouring Degassed Steel in an Argon Atmosphere. Ingot molds are filled with argon to prevent ladle degassed steel from picking up hydrogen, oxygen, and nitrogen when it is teemed. ***William Wilson.*** *Metal Progress,* v. 79, no. 5, May 1961, p. 71-73.

The Importance of Gas Cleanliness for Increased Production on Blast Furnaces. ***Harold Goldfein and Harold Boehme.*** *Blast Furnace and Steel Plant,* v. 49, May 1961, p. 407-412.

Consumable-Electrode Melting of Steels...Present and Future. Consumable-electrode vacuum melting has proved to be a valuable technique for obtaining cleaner ingots which have lower gas content and better mechanical properties than comparable air-melted ingots. ***W. W. Dyrkacz.*** *Metal Progress,* v. 79, no. 5, May 1961, p. 65-70.

Utilization of Fuel Gas by Injection Through Blast Furnace Tuyeres. Concludes that with the use of gas, extremely high blast temperatures may be used without the loss of coke occasioned by increasing the humidity of the blast. Other benefits are cited. ***Eugene R. Dean.*** *Blast Furnace and Steel Plant,* v. 49, May 1961, p. 417-423.

The Continuous Steel Casting Process. Claims that an improvement on ingot casting is definitely obtained if the plant is operated properly, as a result of greater homogeneity through less segregation, a finer crystal structure, and in the case of hard steels, a more favorable carbide distribution. ***Hans Hofmeister.*** *Blast Furnace and Steel Plant,* v. 49, May 1961, p. 403-406.

METALS—FINISHING, POLISHING AND CLEANING

* **Ultrasonic Cleaning: Its Theory and Some Factors Affecting Its Application.** A cleaning process which depends on cavitation for its effectiveness. ***Richard W. Thomas.*** *General Motors Engineering Journal,* v. 8, no. 2, Apr.-May-June 1961, p. 23-28.

* **To Cut Deburring Costs, Mechanize!** Deburring costs are reduced by specifying mechanical methods. The four processes—barrel- and vibratory-finishing, airless and liquid blast—handle almost any job. ***V. C. Spears and D. E. Keener.*** *Metalworking,* v. 17, May 1961, p. 15 + 2 pages.

* **Molten Salt Jet-Sprayed for Cleaning Steel.** *Machinery (New York),* v. 67, no. 9, May 1961, p. 140.

Cleaning Diesel Engine Cylinder Head Castings. Molten Caustic Bath Installation at Leyland. *Metallurgia,* v. 63, Apr. 1961, p. 173-174.

Abrasive Belts Speed Finishing. Set-ups are described. ***John H. Miller.*** *Industrial Finishing (London),* v. 13, May 1961, p. 65 + 2 pages.

METALS—FOUNDRY PRACTICE

Stickiness of Molding and Core Sand Mixtures. Presents advantages of a programming procedure for the preparation of sand mixtures to eliminate sticking of the sand to pattern and core box surfaces. ***Douglas C. Williams.*** *News in Engineering at Ohio State University,* v. 33, no. 1, Feb. 1961, p. 21-22.

* **Pressure-Die-Casting of Complicated Aluminium-Alloy Castings.** Russian foundry experience in production of complex Al automobile components by the pressure-die-casting process, from the choice of alloy to successful production. ***D. P. Tatanov and N. V. Kuranova.*** *Foundry Trade Journal,* v. 110, Apr. 6, 1961, p. 437-438.

* **A Linear Programming Application to Cupola Charging.** Describes the cupola charge problem and the required linear programming formulation and tells how linear programming has been successfully used in a production foundry making cast and malleable iron. ***R. W. Metzger and R. Schwarzbek.*** *Journal of Industrial Engineering,* v. 12, no. 2, Mar.-Apr. 1961, p. 87-93.

* **Dieless Investment Castings for Prototype Testing.** Investment castings from easily fabricated plastic patterns give fast answers to design and development problems. ***E. J. Stefanides, editor.*** *Design News,* v. 16, May 8, 1961, p. 8-9.

* **Relationship Between the Tendency of Green Moulding Sands to Cause Casting Defects and Their Wet Strength.** Tendency to cause defects, testing conditions, and evaluation of test results. (*In German.*) Zusammenhang zwischen Fehlerneigung grüner Formsande und Nassfestigkeit. ***Wilhelm Patterson and Dietmar Boenisch.*** *Giesserei,* v. 48, no. 7, Apr. 6, 1961, p. 157-166.

* **Centrifugal Casting.** The principles and practice of centrifugal casting are discussed and a broad survey of the various techniques is presented. ***J. B. McIntyre.*** *Foundry Trade Journal,* v. 110, Apr. 13, 1961, p. 459-470.

* **Developments in Pressure-Diecasting Machinery for Aluminium.** Essential requirements of automatic operation are reviewed with special reference to the recent developments of automatic metal feed and lubrication. ***E. Gaspar and M. G. Munns.*** *British Foundryman,* v. 54, Apr. 1961, p. 180-188.

* **Gravity Diecasting in a General Foundry.** Relates the complete process of gravity diecasting of cylinder and crankcase castings for compressors and exhausters now in production. Specifications and general characteristics of the alloy used are given, and the casting properties are discussed. ***D. Redfern and I. E. Brown.*** *British Foundryman,* v. 54, Apr. 1961, p. 189-192.

* **Purification of Cast Iron by Oxidation Processes.** Describes a vibration-oxidation technique for removal of trace elements, and demonstrates the effects of high-temperature oxygen surface-lancing, in removing, or reducing the content of, trace elements which may occur in cast irons. ***R. H. T. Dixon.*** *British Foundryman,* v. 54, Apr. 1961, p. 162-170.

* **Production of Sound Grey-Iron Castings.** A survey of recent research into the little-understood problem of achieving soundness in grey-iron castings. ***I. C. H. Hughes.*** *Foundry Trade Journal,* v. 110, Apr. 20, 1961, p. 491-497.

* **Production of Sound Grey-Iron Castings...Survey of Recent Research.** Concluding section of a survey of recent research into the little-understood problem of achieving soundness in grey-iron castings. ***I. C. H. Hughes.*** *Foundry Trade Journal,* v. 110, May 4, 1961, p. 563-568.

* **Particle Coating in Investment Moulds...Solid Fluidization Technique.** A number of drawbacks to the efficient coating of an investment-mold pattern are eliminated by using gas/solid fluidization. *Foundry Trade Journal,* v. 110, May 4, 1961, p. 569-571.

METALS—HEAT TREATMENT

New Furnace Heat Treats Stainless Steel for the B-70's. ***Christy Lambesis.*** *Metal Treating,* v. 12, no. 2, Apr.-May 1961, p. 15 + 1 page.

* **The Heat Treatment of Grey-Iron Castings.** A short survey of some recent work on heat treatment of cast irons which are grey (as cast) or become grey as a result of heat treatment. A modern heat-treatment plant and its control equipment are described. ***W. M. Lord.*** *British Foundryman,* v. 54, Apr. 1961, p. 170-180.

Carbon Control During High Temperature Carburizing. Many heats are extremely fine grained at 1700 F and resist C pick up. However, the higher temperatures coarsen the grain enough on these steels to encourage acceptance of C, and result in a more uniform case structure. ***Robert W. Krogh.*** *Metal Treating,* v. 12, no. 2, Apr.-May 1961, p. 10 + 3 pages.

Effect of Hardenability on Development of Cracks in Tools. Experimental procedure. Effect of quenching temperature on number and shape of cracks. Explanation and shape of cracks. Explanation of the three different types of curves obtained that express this relationship. (Translated from *Stanki i Instrument.*) ***E. I. Malinkina.*** *Metal Treating,* v. 12, no. 2, Apr.-May 1961, p. 12 + 3 pages.

A Design Guide: Preventing Fatigue Failures. III. Heat Treatment and Surface Hardening. Reducing geometric stress concentrations isn't the only way to guard against fatigue failure. Two metallurgical treatments may also be used to extend fatigue life: heat-treating and surface hardening. But results are not always predictable—and sometimes not even desirable. ***F. B. Stulen, H. N. Cummings, and W. C. Schulte.*** *Machine Design,* v. 33, May 25, 1961, p. 146-150.

* **How Forst Heat-Treat Long Broaches.** The 6½ ft.-deep salt baths which form part of a six-furnace heat-treatment line at Forst Broach Co. (Great Britain) Ltd., Dartford Road, Leicester, are believed to be the deepest in the UK. This specially-designed installation for vertically processing broaches up to 6 ft. long has several facets novel to both heat-treatment and broach-production practices. ***David Fishlock.*** *Metalworking Production,* v. 105, no. 19, May 10, 1961, p. 78 + 2 pages.

Spark-Hardening of Cutting Tools, Austenite Formation and Edge Erosion. This paper describes the metallurgical changes which occur when steel is sparked with an electrode of tungsten carbide and draws attention to special problems which arise when the process is applied to cutting tools: the hardening produced by the transfer of carbide is offset by the softening effect of retained austenite and although the hardness of the surface may arise to very high levels, a subcutaneous layer of softened material is always formed; when an edge is sparked the process becomes erosive and tends to blunt the cutting tool. The practical implications of these features are discussed. It is shown that the hardness of the softened regions can be restored by heat treatment after sparking and that blunting of the tool can be prevented by a simple form of edge protection. ***N. C. Welsh and P. E. Watts.*** *Iron and Steel Institute, Journal,* v. 198, pt. 1, May 1961, p. 30-37.

METALS—MECHANICAL AND PHYSICAL PROPERTIES

Ultrasonic Detection of Changes in the Elastic Properties of a 70-30 Iron-Nickel Alloy Upon Heat Treatment. Found that the attenuation from Rayleigh scattering decreased, while that from elastic hysteresis increased as the transformation proceeded. ***Emmanuel P. Papadakis and Everett L. Reed.*** *Journal of Applied Physics,* v. 32, Apr. 1961, p. 682-687.

* **Atomic Heats of Tin and Tin-Indium.** ***M. Yaqub.*** *Cryogenics,* v. 1, no. 3, Mar. 1961, p. 166-170.

Zirconium-Copper Alloy . . . High Strength and Conductivity. Copper with 0.15% Zr added combines good electrical conductivity with moderate strengths and hardnesses up to 660 F. ***A. E. Moredock and D. K. Fox.*** *Metal Progress,* v. 79, no. 4, Apr. 1961, p. 75-77.

Effect of Orientation and Temperature on the Modes of Deformation of Uranium. ***R. O. Teeg and R. E. Ogilvie.*** *Journal of Nuclear Materials,* v. 3, no. 1, Jan. 1961, p. 81-88.

Nuclear Quadrupole Absorption in Indium Metal. Above was observed and studied over the temperature range 4 K to 225 K. ***W. W. Simmons and C. P. Slichter.*** *Physical Review,* v. 121, 2nd ser., no. 6, Mar. 15, 1961, p. 1580-1590.

* **Kinetics and Mechanism of Deformation of Metals During High Temperature Heating and at Different Rates of Expansion.** Plastic deformation of Ni of commercial purity at 600 and 1000 C and with rates of expansion of 0.5 and 2.8×10^{2} mm/hr were studied. Increasing these rates produces an increase in the strengthening effect at these two temperatures. (*In Russian.*) Kinetika i mekhanism deformatsii metallov pri vysokotemperaturnom nagreve i razlichnykh skorostiakh rastiazheniia. ***M. G. Lozinskii and N. Z. Pertsovskii.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Tekhnicheskikh Nauk,* 1961, no. 1, Jan.-Feb., p. 96-107.

Mechanical and Structural Changes During the Deformation of Copper by Fatigue. X-ray diffraction patterns revealed considerable grain distortion at the completion of work-hardening in specimens cycled at a high strain amplitude. ***J. T. McGrath and R. C. A. Thurston.*** *Canada, Mines Branch, Research Report,* R-68, July 1960, 20 pp. (TN26 C16.5r Contin.)

* **Thermal Capacity of Stainless Chromium Steels.** The true heat capacity, temperatures, and heats of the phase transformations of steels 2Kh13, 4Kh13, and 1Kh16s2MB between 30 and 1000 C were evaluated by the method of uninterrupted heating in an adiabatic vacuum calorimeter with up to 1% accuracy. (*In Russian.*) Teploemokost' khromistykh nerzhaveiushchikh staleĭ. ***V. E. Liusternik.*** *Fizika Metallov i Metallovedenie,* v. 11, no. 3, Mar. 1961, p. 368-374.

Influence of Impurity Elements, Structure, and Prestrain on Tensile Transition Temperature of Chromium. Iodide Cr was fabricated into tensile specimens from as-deposited crystals by arc melting, extrusion, swaging, and grinding. The resulting impurity analysis was 0.001 N, 0.001 S, 0.002 oxygen, 0.004 C, and 0.005% total metallics. The separate effects of C, O, and S additions on the tensile properties in the wrought and recrystallized conditions were evaluated as a function of temperature and cooling rate. Detailed information is provided on the recrystallization and grain-growth characteristics of the alloy. ***B. C. Allen, D. J. Maykuth, and R. I. Jaffee.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-837, Apr. 1961, 48 pp. (TL570 Un3t Room 290)

Thermal Expansion of Beta Titanium. Alloying has a significant effect on the thermal-expansion coefficient and also upon the temperature dependence of the thermal-expansion coefficient. Vanadium appears to raise both the magnitude and the rate of increase with temperature of the thermal-expansion coefficient. Aluminum, based on the single alloy studied, also increases the magnitude of the thermal-expansion coefficient, but reduces the rate of increase with temperature. ***D. N. Williams.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 221, no. 2, Apr. 1961, p. 411-412.

A Study of the Spectral Emissivities and Melting Temperatures of Osmium and Ruthenium. Gives expressions for the variation of spectral emissivity with temperature. The melting temperatures of osmium and ruthenium were determined as 3010 ± 10 and 2250 ± 10 C, respectively. ***R. W. Douglass and E. F. Adkins.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 221, no. 2, Apr. 1961, p. 248-249.

Easy Glide and Grain Boundary Effects in Polycrystalline Aluminum. Tensile data for coarse grained aluminum polycrystals suggest that the "grain size" effect is not due to dislocations piled up at grain boundaries but rather is primarily a relative size effect due to surface crystals being weaker and less confined. ***Robert L. Fleischer and William F. Hosford, Jr.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 221, no. 2, Apr. 1961, p. 244-247.

Effect of Hydrogen on the Tensile Properties of Iodide Vanadium. Tensile properties were determined as a function of hydrogen concentration. It was shown that the presence of 10 ppm H is sufficient to cause embrittlement of vanadium over a limited temperature range. The temperature of the observed ductility minimum is approximately −100 C, this being a function of strain rate and hydrogen concentration. The yield stress of hydrogenated vanadium is raised sharply in the brittle temperature range. ***A. L. Eustice and O. N. Carlson.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 221, no. 2, Apr. 1961, p. 238-241.

Effect of Temperature on the Creep of Polycrystalline Aluminum by the Cross-Slip Mechanism. An activation energy of 27,400 ± 1000 cal per mole was obtained over the temperature range of 273 to 350 K, at strains varying from 0.003 to 0.230. Stresses varied from 2250 to 6000 psi, strain rates from 0.1145 x 10^{-5} to 29.5 x 10^{-5} min. $^{-1}$. A strain temperature-compensated time correlation was obtained indicating that the structure was dependent solely upon the strain at a given stress; X-ray diffraction analyses and tensile tests on precrept specimens verified this. ***J. E. Dorn and N. Jaffe.***

American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society, v. 221, no. 2, Apr. 1961, p. 229-233.

a * **A New Variant of the Statistical Electron Theory of the Surface Tension of Metals.** On the basis of the polyhedron method and of the statistical Thomas-Fermi theory, free surface energy of metals (IA and IIA) and its temperature dependency were calculated, taking into account the coulomb energy, the exchange-correlation energy, and the Weizsäcker correction of the Fermi energy. The calculations agree well with new experimental data on melts of alkali and alkaline-earth metals. (*In Russian.*) Novyĭ variant statisticheskoĭ elektronnoĭ teorii poverkhnostnogo natiazheniia metallov. ***S. N. Zadumkin.*** *Fizika Metallov i Metallovedenie,* v. 11, no. 3, Mar. 1961, p. 331-346.

c * **Effect of the Cooling Rate After Tempering on the Creep Strength at 500°C of 0,5% Chromium-0,5% Molybdenum Steel.** With the heat treatment normally used for this steel (norm. + 700 C/air), physical and chemical instabilities may occur under the creep conditions. Thus, widely differing rupture-time curves are obtained depending on heat treatments and whether or not the metal has been stored before testing. Tests have been carried out to establish a relation between the existence of a "kink" in the rupture-time curve, ductility at high temperature and migration of elements between ferrite and carbides. (*In French.*) Influence de la vitesse de refroidissement après revenu sur la résistance au fluage à 500°C d'un acier à 0,5% Cr-0,5% Mo. ***J. Bellot, L. Bäcker, M. Hugo, and E. Herzog.*** *Revue de Métallurgie, Mémoires Scientifiques,* v. 58, no. 2, Feb. 1961, p. 151-159.

e * **Contribution to the Study of the Fatigue Mechanism in Slightly Carburized Iron.** The study of torsion curves in plane specimens of "Ugiperval" steel has shown the marked influence of prior heat treatment on the mechanical properties obtained. In particular, the solution treatment of carbon at 720 C for several minutes followed by quenching into water improves considerably the fatigue limits of the metal. (*In French.*) Contribution à l'étude du mécanisme de la fatigue dans le fer faiblement carburé. ***J. de Fouquet.*** *Revue de Métallurgie, Mémoires Scientifiques,* v. 58, no. 2, Feb. 1961, p. 129-137.

* **X-Ray Methods of Study of Plastically Deformed Metals.** (*In Russian.*) Nekotorye rentgenograficheskie metody izucheniia plasticheski deformirovannykh metallov. ***D. M. Vasil'ev and B. I. Smirnov.*** *Uspekhi Fizicheskikh Nauk,* v. 73, no. 3, Mar. 1961, p. 503-558.

g * **Effects of Low Hydrogen Contents on the Mechanical Properties of Titanium Alloys.** The observed effects of low H contents on the characteristics obtained in testing the expansion of IMP1A and IMP7 sheet specimens, and the increase of these effects with the decrease of the section of the specimens shows that the permissible standards for the H content in parts made with these sheets must be more differentiated. For thin sheets or h foils the tolerances for the H content must be more exacting than for material with a heavier transversal section. (*In Russian.*) Vliianie malykh soderzhaniĭ vodoroda na mekhanicheskie svoĭstva titanovykh splavov. ***E. V. Petunina and V. L. Poplavskaia.*** *Metallovedenie i Termicheskaia Obrabotka Metallov,* 1961, no. 4, Apr., p. 25-27.

i * **The Effect of Deformation on the Cold Rolling and Recrystallization Textures of Silicon-Iron Sheets.** For the production of a secondary (110)[100] recrystallization texture, the presence of these texture components in the primary structure is not enough. The stronger the (111)[112] texture and the (110)[100]-orientation in the cold rolled sheets, the more marked is the Goss condition. Since the two conditions are not fulfilled in one-pass rolling, a cold rolling of over 86% in the secondary recrystallization eliminates the Goss-condition. (*In German.*) Zur Frage des Einflusses der Verformung auf die Kaltwalz- und Rekristallisationstexturen von Eisen-Silizium-Blechen. ***Konrad Sagel.*** *Archiv für das Eisenhüttenwesen,* v. 32, no. 3, Mar. 1961, p. 153-164.

Effect of Plastic Strains on Mechanical Properties of Five Steels. The effects of plastic strain, aging, and stress relieving were studied by means of notch impact and tensile tests on five 1 in. mild steel plates. Strains just exceeding the yield point (4-5%) shifted the Charpy V-notch curves to higher tempera-

tures and the 15 ft-lb transition by from 20 to 30 C. Stress relieving at 650 C brought the curves back towards the original values, but only in one steel was recovery nearly complete. Samples cut transverse to the direction of rolling and straining showed less recovery. ***C. F. Tipper.*** *British Welding Journal*, v. 8, May 1961, p. 278-281.

* **Plastic Stress-Strain Relations and Yield Surfaces for Aluminium Alloys.** ***H. J. Ivey.*** *Journal of Mechanical Engineering Science*, v. 3, no. 1, Mar. 1961, p. 15-31 + 1 plate.

* **Hydrogen Brittleness of Austenitic Steel.** 1Kh18N9T steel was tested with cathode and gas saturated H. When H appears in the entire section of the specimen, brittleness develops independently of the method used in introducing H into the steel. A high H content in this steel does not cause any marked brittleness if H is concentrated preferably in the surface layers without spreading to the entire section of the specimen. The tendency of austenitic steel containing H to brittleness increases with increase of temperature and decreases in speed of the test. (*In Russian.*) O vodorodnoĭ khrupkosti austenitnoĭ stali. ***E. P. Nechaĭ and K. V. Popov.*** *Fizika Metallov i Metallovedenie*, v. 11, no. 2, Feb. 1961, p. 224-228.

METALS—MECHANICAL WORKING

Fabrication Studies on Columbium Alloy Sheet. Preliminary tests indicate that D-31 sheet (10% Mo, 10% Ti) has relatively good formability; its machining characteristics are similar to austenitic stainless steel. The alloy has fair bendability, but its weldability leaves much to be desired. The material can be sheared cold; it can be dimpled at 500 F but not at room temperature. ***Andrew F. Trabold and Steven Bank.*** *Metal Progress*, v. 79, no. 5, May 1961, p. 103-107.

* **Chatter Patterns Formed on the Surface of Thin Cylindrical Tubes During Machining.** The patterns formed on the surface of thin cylinders during machining are shown to result from self-induced and forced vibration. As metal is removed, the natural frequency of the cylinder slowly decreases, thus decreasing the number of surface waves accommodated around the circumference. The pattern repeats itself each time the number of surface waves per revolution is decreased by one. The slow rise and fall of vibration intensity depends in the main on the interaction of part of the cutting tool with the surface waves cut during the previous revolution. ***Ronald N. Arnold.*** *Journal of Mechanical Engineering Science*, v. 3, no. 1, Mar. 1961, p. 7-14 + 2 plates.

METALS—METALLOGRAPHY, TRANSFORMATIONS, AND STRUCTURES

* **Study of the Nature of a Chemical Compound in the Ti-Si System.** By means of microchemical and X-ray analysis was discovered the existence of Ti_5Si_3 compound. (*In Russian.*) Issledovanie prirody khimicheskogo soedineniia v sisteme Ti-Si. ***R. B. Golubtsova.*** *Akademiia Nauk SSSR, Doklady*, v. 137, no. 4, 1961, p. 859-861.

* **Electrographic Investigation of Metastable Phases in Au-Sb, In-Sb, In-Bi, In-Bi-Sb Alloys.** In the Au-Sb alloys a new metastable phase, which can be considered as a solid solution based on the intermetallic $AuSb_2$ compound, was observed. The new phase is a cubic compound of the In_2Bi_2 composition, having a hexagonal lattice (a = 1.7 Å, c = 8.53 Å, c/a = 0.73). The topological structure of the equilibrium diagram of the In-Bi-Sb system was determined. (*In Russian.*) Elektronograficheskoe issledovanie metastabil'nykh faz v splavakh Au-Sb, In-Sb, In-Bi, In-Bi-Sb. ***L. S. Palatnik, V. M. Kosevich, and L. V. Tyrina.*** *Fizika Metallov i Metallovedenie*, v. 11, no. 2, Feb. 1961, p. 229-235.

* **Structure of Cast Iron Quenched From the Molten State.** At cooling rates of crystallizing cast irons up to 10^8 degree/sec, there is a diffusion distribution of the constituents in the molten phase. The austenite thus obtained contains less than 2% C. In rapidly cooled films of hypoeutectic cast iron, a distinct crystallization of austenite and cementite occurs mostly. In hypereutectic cast irons it is much more difficult to obtain a distinct crystallization, since the eutectic forms as an independent phase content. (*In Russian.*) Struktura chuguna, zakalennogo iz zhidkogo sostoianiia. ***I. S. Miroshnichenko and I. V. Salli.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Tekhnicheskikh Nauk*, 1961, no. 1, Jan.-Feb., p. 44-48.

* **The Effects of Impurities on the Behavior of Gallium Single Crystals Near the Melting Point.** The Ga specimen studied contained 0.0730% Sn. A eutectic agglomeration was formed. The partial melting of the crystal began at the eutectic temperature t_e of the Ga-Sn system ($20.3\ C < t_e < 20.7\ C$) and the amount of liquid can be calculated by means of a diagram representing the states of this system. The eutectic temperature of the Ga alloys with Pb is higher than 29.3 C according to literature data. However, the electrical resistivity and mass heat of Ga with 0.0550% Pb vary abnormally from 28.5 C. It seems that the Ga single crystal contaminated by Pb undergoes a modification near the melting point which is not yet the complete change to liquid phase. (*In French.*) L'influence des impuretés sur le comportement des monocristaux de gallium près du point de fusion. ***S. Lignel and M. M. Erny.*** *Métaux Corrosion-Industries*, v. 36, Feb. 1961, p. 51-69.

* **Structure Modifications of Metals and Alloys Under the Effects of Irradiation.** The effects of irradiation on the phase changes are manifested by the acceleration of the diffusion mechanism due to a saturation of the vacancies if the temperature is sufficient to allow enough mobility to the atoms (precipitation of Be in oversaturated CuBe and NiBe alloys); by the appearing of high temperature structure due to the punctual thermal effects of irradiation followed by sudden tempering (transformation of zirconia); by the distribution of defects which cause the lattice to expand until a change in the structure occurs (Barium titanate). (*In French.*) Modifications de structure des métaux et des alliages sous l'effet de l'irradiation. ***Daniel Calais.*** *Métaux Corrosion-Industries*, v. 36, Feb. 1961, p. 70-84.

High Temperature Metallography. Contains descriptions of new methods of investigation and apparatus which make possible the study of the microstructure and properties of metals and alloys at high temperatures *in vacuo*. Deals with the construction and maintenance of apparatus, calculation of parameters for the various components of these vacuum systems, the special forms of the specimens needed, and the theoretical basis for the calculation of the physical properties of metals and alloys as related to these new methods of investigation and with the practical applications of the methods. ***M. G. Lozinskii.*** 484 pp. + 118 plates. 1961. Pergamon Press, New York. (TN690 L95vtr)

* **Phase Transformations in the Reduction Processes and Oxide Oxidation of Uranium.** Kinetic investigation of the reduction processes of higher U oxides (UO_3 and U_3O_8) by H were completed by radiostructural study of the products of reduction. No other phases are formed except solid solutions on the basis of U_3O_8, U_4O_9, and UO_2. During the oxidation of uranium dioxide by pure O and the O of the air, tetragonal phases are formed only below 400 C. X-rays confirm that U dioxide is not oxidized in CO_2 atmosphere. (*In Russian.*) Fazovye prevrashcheniia v protsessakh vosstanovleniia i okisleniia okislov urana. ***V. N. Strekalovskii, A. F. Bessonov, V. G. Vlasov, and F. A. Sidorenko.*** *Fizika Metallov i Metallovedenie*, v. 11, no. 3, Mar. 1961, p. 400-403 + 1 plate.

* **Crystallization of the Ni-C Alloy. I. Effects of the Speed of Cooling on the Formation of Zones With Globular and Lamellar Graphite. II. Effects of Sulfur on the Formation of Zones With Globular and Lamellar Graphite.** (*In Russian.*) Kristallizatsiia splava Ni-C. I. Vliianie skorosti okhlazhdeniia na formirovanie zon s sharovidnym i plastinchatym grafitom. II. Vliianie sery na formirovanie zon s sharovidnym i plastinchatym grafitom. ***I. E. Bolotov.*** *Fizika Metallov i Metallovedenie*, v. 11, no. 3, Mar. 1961, p. 420-434.

METALS—POWDER

Fundamental Principles of Powder Metallurgy. Covers powder manufacture, pressing, shaping, sintering, attainment of specific properties, continuous processes, and control methods. ***W. D. Jones.*** 1032 pp. 1960. Edward Arnold Ltd., London. (TN695 J72f)

NONDESTRUCTIVE TESTING AND QUALITY CONTROL

* **Trends in the Development of Nondestructive Testing of Light Metals in X-Rays and Radioisotopes.** In X-radiation suitable identification of errors, with speed in taking films and a sparing use of image on screen is obtained by xero-radiography, electronic image-amplifier and semiconductor-amplifier screen. Thulium-170 and Europium-155 are used as radioisotopes suitable for the radiography of light metal pieces. X-ray fluorescence analysis and local microanalysis with electron beam excitation are dealt with. (*In German.*) Entwicklungstendenzen auf dem Gebiet der zerstörungsfreien Prüfung von Leichtmetallwerkstücken mit Röntgenapparaten und Radioisotopen. ***F. Rohner.*** *Metall*, v. 15, Mar. 1961, p. 216-219.

* **Can Flakes Be Detected as Such in Forgings With the Aid of the Pulse Echo Method?** Difficulties encountered in ultrasonic testing—detection of flakes in the standard case—reflectograms diverging from the standard case and their causes. (*In German.*) Lassen sich Flocken in Schmiedestücken mit Hilfe des Impulsechoverfahrens als solche nachweisen? ***Günter Beckmann.*** *Neue Hütte*, v. 6, Feb. 1961, p. 99-106.

* **Optical Gaging Speeds Boring.** A three-way method of drilling and boring and inspecting holes in medium and large-sized workpieces. Involves close integration of a highly precise machine tool with $20,000 worth of optical gaging equipment—in a setup so designed as to eliminate tying up of the machine during inspection. ***Kenneth Frommer.*** *American Machinist*, v. 105, May 1, 1961, p. 71-73.

Proceedings of the Symposium on Nondestructive Testing Trends in the AEC Reactor Program. Symposium held at Atomic Energy Commission Headquarters Building, Germantown, Maryland, May 20, 1960. *U. S. Atomic Energy Commission, TID-7600*, Mar. 1961, 86 pp. (UF767 Un3ti Contin.)

Quality Control in Sheet Production. New Classifier Developed by English Electric. Faults such as pinholes, off-gage and poor surface finish are detected during the inspection of the continuous strip. *Metallurgia*, v. 63, Apr. 1961, p. 191-192.

NUCLEAR PHYSICS, NUCLEONICS, AND RADIATION

The Cern 600 MeV Synchrocyclotron at Geneva. I. Object and Design. II. The Radio-Frequency System. III. The Tuning-Fork Modulator. I. ***W. Gentner.*** II. ***K. H. Schmitter and S. Kortleven.*** III. ***B. Bollée and F. Krienen.*** *Philips Technical Review*, v. 22, no. 5, 1960-1961, 39 pp.

High Voltage Electron-Beam Processing. Brochure covers widespread industrial applications of penetrating radiation. 31 pp. High Voltage Engineering Corporation, Burlington, Mass. (QC786 H53h Over.)

An Estimate of the Effect of Radiation on the Thermal Conductivity of Beryllium. From existing data on the effect of reactor irradiation on the electrical resistivity of beryllium, the effect of reactor irradiation at low temperatures on the thermal conductivity is predicted. ***G. J. Dienes and A. C. Damask.*** *Journal of Nuclear Materials*, v. 3, no. 1, Jan. 1961, p. 16-20.

* **Nuclear Safety.** Review is intended to assist those interested in keeping abreast of significant developments in the field of nuclear safety. *Nuclear Safety*, v. 2, no. 2, Dec. 1960, 91 pp.

(n,2n), (n,p), And (n,α) Excitation Functions of Several Nuclei From 7.0 to 19.8 Mev. ***B. P. Bayhurst and R. J. Prestwood.*** *U. S. Atomic Energy Commission, LA-2493*, Mar. 10, 1961, 50 pp. (UF767 U3La Contin.)

Basic Principles of Fission Reactors. Takes the reader to the stage where detailed reactor design begins, assuming only an appropriate background of physics, mathematics, and chemistry. Mathematical treatment has been chosen to clarify basic principles and can be ignored without detracting from the subsequent logical development of the book. Only such nuclear physics as is necessary for an understanding of reactors is given, and this is not introduced until it is required, so that it is first encountered in some reactor context. The reactors described in this book are all of historical importance and are selected to illustrate the different parts of the test. ***W. R. Harper.*** 314 pp. 1961. Interscience Publishers, New York. (TK9202 H23b)

* **Experimental Results on the $\pi\pi$ Cross Section.** From a total of 1275 inelastic events with the proton stopping in the chamber. ***Jerry A. Anderson, et al.*** *Physical Review Letters*, v. 6, no. 7, Apr. 1, 1961, p. 365-367.

AGR. A detailed description of the Advanced Gas-Cooled Reactor, including drawings. *Nuclear Engineering*, v. 6, Apr. 1961, p. 151-158 + 1 plate.

Dynamics of Atomic Motions in Liquids and Cold Neutron Scattering. The self-correlation function for the motion of an atom in a liquid has been constructed in a manner which simulates the behavior of this function bteween the two extreme cases, viz., that in a solid and that in a simple diffusive model. ***A. Rahman, K. S. Singwi, and A. Sjölander.*** *Physical Review*, v. 122, 2nd ser., no. 1, Apr. 1, 1961, p. 9-12.

Annihilation of Positrons in LiH. The data yield a wave-function product density distribution much wider than the outer-shell electron density around the negative ion. ***A. T. Stewart and R. H. March.*** *Physical Review*, v. 122, 2nd ser., no. 1, Apr. 1, 1961, p. 75-76.

Mechanism of the Reaction $O^{16} + p \rightarrow p + 4\alpha$ at 29 Mev. Two-hundred and twelve events were obtained that satisfied the criteria of energy and momentum balance. ***Oscar C. Kolar.*** *Physical Review*, v. 122, 2nd ser., no. 1, Apr. 1, 1961, p. 139-150.

Angular Yield of Neutrons From the T(d,n)He^4 Reaction for 6- to 11.5-Mev Deuterons. ***Murrey D. Goldberg and James M. Le Blanc.*** *Physical Review*, v. 122, 2nd ser., no. 1, Apr. 1, 1961, p. 164-168.

Average Radiative Capture Cross Sections for 7- to 170-kev Neutrons. ***J. H. Gibbons, R. L. Macklin, P. D. Miller, and J. H. Neiler.*** *Physical Review*, v. 122, 2nd ser., no. 1, Apr. 1, 1961, p. 182-201.

Design Evaluation and Comparison 200 MWe Boiling D_2O Pressure Tube Indirect and Direct Cycle Power Reactor Plants. *U. S. Atomic Energy Commission, NDA-2131-6*, June 30, 1960, 113 pp. (UF767 Un3.1nd Contin.)

Conceptual Design of a Snap III Type Generator Fueled With Cerium-144. The output of a single unit would be 3.8 watts at launch, decreasing to 1.9 watts in the course of a 6-month mission. ***Robert J. Wilson.*** *U. S. Atomic Energy Commission, MND-P-2369*, June 1960, 46 pp. (UF767 Un 3.1 mn Contin.)

Natural Alpha Radioactivity in Medium-Heavy Elements. A large cylindrical ionization counter accommodating samples up to 1200 cm^2 in area was used. ***Ronald D. Macfarlane and Truman P. Kohman.*** *Physical Review*, v. 121, 2nd ser., no. 6, Mar. 15, 1961, p. 1758-1769.

Radiative Decay Modes of the Muon. A 5-in. freon bubble chamber was used to search for decay modes of the μ^+ meson. ***R. R. Crittenden, W. D. Walker, and J. Ballam.*** *Physical Review*, v. 121, 2nd ser., no. 6, Mar. 15, 1961, p. 1823-1832.

* **Neutron Capture Chains in Heavy Element Synthesis.** Concerns stellar neutron capture processes which occur at a rate slow compared to the intervening beta decays, the so-called *s*-process in the synthesis of the elements. ***D. D. Clayton, W. A. Fowler, T. E. Hull, and B. A. Zimmerman.*** *Annals of Physics*, v. 12, Mar. 1961, p. 331-408.

* **Breakup of Deuterons on H, D, He^3 and He^4.** Above studied by the time-of-flight technique. ***B. V. Rybakov, V. A. Sidorov, and N. A. Vlasov.*** *Nuclear Physics* v. 23, no. 3, Mar. 1961, p. 491-498.

* **Cross Sections for the (γ, n) Reaction in Cu^{63}, Cu^{65}, Zn^{64}, Sb^{121} and Pr^{141}, Measured With Monochromatic Gamma Rays.** ***G. E. Coote, W. E. Turchinetz, and I. F. Wright.*** *Nuclear Physics*, v. 23, no. 3, Mar. 1961, p. 468-480.

* **Some Be^9(d, pγ)Be^{10} Angular Correlation Measurements Off the Stripping Peak.** ***F. H. Read, J. M. Calvert, and G. Schork.*** *Nuclear Physics*, v. 23, no. 3, Mar. 1961, p. 386-398.

* **Measurement of the Photoprotons From Argon and Oxygen.** A thin CsI(Tl) crystal was used to measure the yield of photoprotons for a 34.5 MeV bremsstrahlung spectrum. The following values relative to the yield of the $C^{12}(\gamma, n)$ reaction were obtained: 2.45 $\pm$ 0.35 for Ar and 2.06 $\pm$ 0.28 for O. An upper limit of the integrated cross section for the (γ, *n*)- and (γ, *p*.)-reaction in O_2 is given. (*In German.*) Messung der Photoprotonen aus Argon und Sauerstoff. ***E. Finckh and U. Hegel.*** *Zeitschrift für Physik*, v. 162, no. 2, 1961, p. 154-159.

The Range-Energy Relation for High Energy μ-Mesons. Energies up to 1000 Gev have been studied by comparing the sea-level energy spectrum of cosmic rays with the underground depth-intensity curve. ***F. Ashton.*** *Physical Society, Proceedings*, v. 77, pt. 3, Mar. 1961, p. 587-592.

Graphite-Matrix Fuel Bodies. Most contemporary designs call for graphite-matrix elements in simple tubular form in part because more intricate shapes are not readily fabricated by conventional means but complex shapes are now attainable by screw extrusion. The profile need only be biaxially symmetric in cross section and the wall thickness relatively uniform. ***T. M. Benziger and R. K. Rohwer.*** *Nucleonics*, v. 19, May 1961, p. 80 + 3 pages.

* **Modified Flammersfeld Range Energy Relation for Electrons.** The modified relation yields satisfactory results down to 2 Kev and passes smoothly to its original form above 0.2 Mev in Al. ***S. P. Khare and Y. P. Varshni.*** *Annalen der Physik*, v. 7, nos. 3-4, Jan. 1961, p. 220-224.

* **Energy Distribution of Neutrons Produced by a Thermonuclear Reaction.** Assumes that the reacting mixture of gases is in the thermodynamic equilibrium. ***W. R. Faust and E. G. Harris.*** *Nuclear Fusion*, v. 1, no. 1, Sept. 1960, p. 62-63.

* **Direct Current Stabilization of Scintillation Counters Used With Pulsed Accelerators.** A simple system for the gain stabilization of the photomultiplier of a scintillation counter. Use is made of a constant light source. ***F. P. G. Valckx.*** *Nuclear Instruments and Methods*, v. 10, Mar. 191, p. 234-236.

Synchrotron Radiation From Mirror Machine Geometries. The radiation due to the orbiting of electrons in a confining magnetic field has been numerically integrated over a thermal velocity distribution perpendicular to the magnetic field as a function of frequency of emitted radiation and the angle the radiation propagation vector makes with the magnetic field. ***David B. Beard and John C. Baker.*** *Physics of Fluids*, v. 4, no. 5, May 1961, p. 611-618.

* **Vibrations of Spherical Nuclei.** The particle-hole interaction is discussed as the mechanism for producing vibrational states in nuclei. ***G. E. Brown, J. A. Evans, and D. J. Thouless.*** *Nuclear Physics*, v. 24, no. 1, Apr. 1961, p. 1-17.

* **Emission of Fast Particles in a Heterogeneous Medium.** Concerns the radiation arising in the passage of relativistic particles of constant velocity through an arbitrary periodical heterogeneous medium. The necessary condition of the origin of radiation, the condition of resonance is derived on the basis of the laws of conservation of energy and momentum. ***M. L. Ter-Mikaelyan.*** *Nuclear Physics*, v. 24, no. 1, Apr. 1961, p. 43-61.

* **γ Rays From an Extranuclear Direct Capture Process.** Direct electric dipole capture γ-ray transitions are calculated for a number of cases of charged particle capture in nuclei. It is found that when the γ-ray energy is sufficiently low - below about 2 MeV - the capture matrix element is determined by regions external to the usual "nuclear radius". ***R. F. Christy and Ian Duck.*** *Nuclear Physics*, v. 24, no. 1, Apr. 1961, p. 89-101.

* **Neutron-Gamma Angular Correlation Studies of the B^{11}(d, nγ)C^{12} Reaction.** ***J. B. Garg, N. H. Gale, and J. M. Calvert.*** *Nuclear Physics*, v. 23, no. 4, Mar. 1961, p. 630-647.

* **The C^{12}(d,n)N^{13} Reaction Up to 1.35 MeV.** Results are interpreted in terms of compound nucleus formation. ***A. N. James.*** *Nuclear Physics*, v. 23, no. 4, Mar. 1961, p. 648-656.

Measurement of Nanosecond Scintillation Decay Times. Involves a repetitive time selection technique; i.e., in a sense, it is the electronic equivalent of the original Becquerel phosphoroscope. ***H. Dreeskamp, A. K. Ghosh, and Milton Burton.*** *Review of Scientific Instruments*, v. 32, Mar. 1961, p. 304-307.

Recalibration of Standard Thermal Neutron Flux. A recent gold foil recalibration sets the new value at 4,203 neutrons/cm^2-sec. *National Bureau of Standards, Technical News Bulletin*, v. 45, Mar. 1961, p. 43.

* **Fast Proton Fission of Antimony Nuclei.** It was established that the curve connecting the magnitudes of the most probable charges, is located near the line of nuclear stability. With the energy decrease of incident protons to 220 Mev the product yield of assymetric fission of antimony are decreased almost ten-fold. (*In Russian.*) Delenie iader sur'my bystrymy protonami. ***A. K. Lavrukhina, E. E. Rakovskiĭ, Su Khun-Gui, and S. Khoinatskiĭ.*** *Akademiia Nauk SSSR, Doklady*, v. 137, no. 4, 1961, p. 826-829.

Simple Realistic Treatment of Nuclear Direct-Interaction Processes. Physical arguments are used to predict qualitatively the effect on direct-interaction differential cross sections of the distortion of the wave functions of the scattered particle. ***Ian E. McCarthy and Derek L. Pursey.*** *Physical Review*, v. 122, 2nd ser., no. 2, Apr. 15, 1961, p. 578-590.

The European BR2 Reactor at Mol, Belgium. A powerful reactor of advanced design for testing fuel elements and other materials to be used in power stations. ***Georges Denègre, Georges Stiennon, and Fernand Léonard.*** *New Scientist*, v. 9, Apr. 6, 1961, p. 877-879.

* **Bibliography on Nuclear Reactor Fuel Reprocessing and Waste Disposal. Fission Product, Poison, and Radioisotope Removal.** Includes Section 2.0 of eight sections of a bibliography on nuclear reactor fuel reprocessing and waste disposal. The collection will be a unit, and cross references are made between volumes. The decimal coding of headings is designed for ease of cross referencing, filing, expansion, and for future use in an automatic microfilm viewer-printer now being developed. ***T. F. Connolly.*** v. II. 152 pp. Oct. 18, 1960. Oak Ridge National Laboratory, Oak Ridge, Tenn. (ZTK9360 Un3.1b Ref.)

Table of Atomic Masses. Data are correlated according to mass. ***J. W. Guthrie, editor.*** *U. S. Atomic Energy Commission, SCR-245*, Feb. 1961, 302 pp. (UF767 Un3.1scr Contin.)

* **Calculation of Radial Motion of Plasma by Inductive Pinch.** Infinite conductance of thin carrying layer and total racking of plasma are assumed. Calculated rates of conversion are 1.5 to 2 times as great as the experimental values of interest to the studies in the field of thermonuclear reactions. (*In Russian.*) Raschet radial'nogo dvizheniia plazmy pri iduktsionnom pinche. ***A. A. Pliutto and K. N. Kervalidze.*** *Zhurnal Tekhnicheskoĭ Fiziki*, v. 31, no. 4, Apr. 1961, p. 400-406.

Examination of PWR Core 1 Blanket Fuel Rods for Microstructure, Hydrogen Pickup, and Burst Strength. Results of three investigations performed upon natural UO_2 fuel rods removed from the PWR blanket after 5800 efph of operation. ***B. Rubin.*** *U. S. Atomic Energy Commission, WAPD-TM-264*, Feb. 1961, 35 pp. (UF767 Un3.1wa Contin.)

* **Origin of Intense γ-Radiation Connected With Slow Neutron Absorption by Uranium^{235}.** The γ-radiation of 4.49 MeV observed at Chalk-River in the absorption of slow neutrons by ^{235}U was studied by selecting the neutrons by the flight-time method and thus by distinguishing the resonances where the radiation capture predominated. It seems that the spectrum of the γ-radiations of radiation capture of the neutrons in ^{235}U exhibits an intense component toward 4.5 MeV. (*In French.*) Origine d'un rayonnement γ intense lié à l'absorption de neutrons lents par l'uranium^{235}. ***Francis Netter, et al.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences,* v. 252, no. 12, Mar. 20, 1961, p. 1759-1761.

Scattering of Slow Neutrons by Molecules. Above has been analyzed for incident neutron energy of the same order of magnitude as the rotational level separations with no approximations. ***A. Rahman.*** *Reactor Science,* v. 13, nos. 3-4, Jan. 1961, p. 128-132.

* **Lepton Conservation and Double Beta-Decay.** If the lepton part of the universal *V-A* current operator is linear in the massless Majorana neutrino field, leptons are conserved. The intermediate state neutrino is completely polarized and may not be reabsorbed to produce a neutrinoless double β-decay final state. Two light modifications of the interaction, (1) finite neutrino mass, and/or (2) a deviation from exact equality of the effective *V* and *A* lepton currents, result in the creation of an incompletely polarized intermediate state neutrino which may then be reabsorbed. Neutrinoless double beta-decay, in violation of lepton conservation, is then possible. ***Eugene Greuling and R. C. Whitten.*** *Annals of Physics,* v. 11, Dec. 1960, p. 510-533.

An Electrostatic-Magnetic Separator for Obtaining Isotopes of High Purity. The design of a 30-inch radius combined velocity and direction focusing mass analyzer is described as is application of this instrument as a high purity isotopic separator for research in nuclear physics, metallurgy, and semiconductors. ***F. A. White, F. M. Rourke, J. C. Sheffield, and L. A. Dietz.*** *IRE Transactions on Nuclear Science,* v. NS-8, no. 2, Apr. 1961, p. 13-21. (TK1 In6.6ns Vis.)

* **The Distribution of Neutron Spectrum Temperatures in an Infinite Plate of a Heavy Gas Moderator.** ***Zbigniew Weiss.*** *Nukleonika,* v. 5, no. 12, 1960, p. 795-810.

The Effects of Atomic Motions on the Moderation of Neutrons. Develops a first-order differential equation for the neutron spectrum in an energy region where the effects of chemical binding are significant but not dominant. ***Donald E. Parks.*** *Nuclear Science and Engineering,* v. 9, Apr. 1961, p. 430-441.

* **Inconsistency of the Local Field Theory of Charged Spin 3/2 Particles.** The relativistic quantum theory of Fermi Dirac fields of arbitrary spin is investigated and a general theorem is proved which asserts that for fields of half integral spin the possibility of a consistent quantization requires that the equal-time anticommutators must be functions of the other fields to which the field in question is coupled. ***Kenneth Johnson and E. C. G. Sudarshan.*** *Annals of Physics,* v. 13, Apr. 1961, p. 126-145.

International Series of Monographs on Nuclear Energy. Thermal Reactor Theory. A comprehensive account of the theory of thermal nuclear reactors. The mathematical physics of the various aspects of the subject is discussed in the first part of the book, the detailed mathematical arguments being left to the second part. To assist the practical worker, the formulae given in the text are reduced, as far as possible, to forms in which numerical values can be substituted. ***A. D. Galanin.*** 2nd Rev. Ed. 412 pp. 1960. Pergamon Press, New York. (TK9202 G13t2tr)

* **A Source of Polarized Deuterons and the Detection of Polarization by the (*d*,*T*) Reaction.** The design, construction, and test of a source of polarized deuterons is described. Three hyperfine components of an atomic deuterium beam are separated in a strong magnetic quadrupole field. The beam then passes into a weak homogeneous field, where the atoms are ionized by electron bombardment. (*In German.*) Eine Quelle polarisierter Deuteronen und Nachweis der Polarisation durch die (*d*,*T*)-Reaktion. ***H. Rudin, H. R. Striebel, E. Baumgartner, L. Brown, and P. Huber.*** *Helvetica Physica Acta,* v. 34, no. 1, 1961, p. 58-84.

a * **Electromagnetic Structure of the Nucleon.** Spectral representations of the electromagnetic form factors of the nucleon for fixed momentum transfer are proved as a function of the square of the four-momentum of the nucleon, based on the general principles of the quantum field theory and, using these representations, two sets of coupled equations for charge and magnetic moment form factors are derived. ***Ken Kawarabayashi and Shigeru Machida.*** *Progress of Theoretical Physics,* v. 25, no. 1, Jan. 1961, p. 17-34.

b **Burnup Experience in EBWR.** Fuel elements and control rods show excellent burnup resistance in long-term operation of the Experimental Boiling Water Reactor but control parameters undergo changes adverse to reactor safety. ***Joseph A. Thie.*** *Nucleonics,* v. 19, May 1961, p. 60-62.

c * **Nuclear Fission.** The part that chemistry has played and will continue to play in nuclear fission development is described. ***G. N. Walton.*** *Chemical Society, Quarterly Reviews,* v. 15, no. 1, 1961, p. 71-98.

d * **New Element, Lawrencium, Atomic Number 103.** Bombardments of californium with boron ions have produced alpha-particle activity which can only be ascribed to decay of a new element with atomic number 103. This activity at best amounts to only a few alpha counts per hour, so it has not yet been possible to detect the mendelevium decay product to prove further the atomic number of the new activity. For the present, attribution of this activity to element number 103 must rest entirely on nuclear rather than chemical evidence. ***Albert Ghiorso, Torbjørn Sikkeland, Almon E. Larsh, and Robert M. Latimer.*** *Physical Review Letters,* v. 6, no. 9, May 1, 1961, p. 473-475.

e * **The Microtron.** The machine is very suitable for research purposes such as studies on the scattering of electrons, the spectra of high energy X-rays, etc., where a primary beam having a small energy spread and angular divergence is a great advantage. ***R. E. Jennings.*** *Contemporary Physics,* v. 2, no. 4, Apr. 1961, p. 277-285.

f * **A Study of Mercury-192 Disintegration.** Fifteen transitions were revealed by the analysis of the conversion lines. The period of Hg-192 disintegration was measured. The relative intensities of the γ rays were evaluated by spectral decomposition. The limits of the values of the periods for the most important transitions were given. (*In French.*) Étude de la désintégration du mercure 192. ***Jerzy Jastrezbski and Pierrette Kilcher.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences,* v. 252, no. 15, Apr. 10, 1961, p. 2220-2222.

g * **Anomalous Reflections in a Single Crystal Neutron Spectrometer.** The counting rate vs. Bragg-angle curve obtained with a single crystal neutron spectrometer shows fluctuations which are identified as due to double Bragg-reflections by the crystal. ***V. P. Duggal, K. Raghavendra Rao, C. L. Thapar, and V. Singh.*** *Indian Academy of Sciences, Proceedings,* v. 53, sec. A, no. 2, Feb. 1961, p. 59-72.

h * **Physical Measurements by the Photographs of Particle Tracks in Bubble Chambers.** (*In Russian.*) Fizicheskie izmereniia po fotografiiam sledov chastits v puszyr'kovykh kamerakh. ***I. I. Pershin.*** *Uspekhi Fizicheskikh Nauk,* v. 73, no. 3, Mar. 1961, p. 539-581.

i * **Concerning the Calculation of the Nuclear Moment of Inertia.** Using the generalized method of canonical transformation an expression for the above is found with allowances for nuclear pairing. ***S. T. Beliaev.*** *Nuclear Physics,* v. 24, no. 2, Apr. 1961, p. 322-325.

j * **An Experimental Test of the Statistical Theory of Nuclear Reactions.** The 14 MeV differential (n, p) cross-sections of about 40 nuclei have been measured at 120° to the incident neutrons using a photographic plate method. The results are compared with the cross sections calculated according to the statistical theory of nuclear reactions and it is shown that good agreement exists between theory and experiment. ***D. L. Allan.*** *Nuclear Physics,* v. 24, no. 2, Apr. 1961, p. 274-299.

k

Fabrication Development of UO_2-Stainless Steel Composite Fuel Plates for Core B of the Enrico Fermi Fast Breeder Reactor. Concerns development of an inexpensive composite fuel plate with a high burnup potential for application in a 500 C sodium environment as Core B of the Enrico Fermi Fast Breeder Reactor. ***J. H. Cherubini, R. J. Beaver, and C. F. Leitten, Jr.*** *U. S. Atomic Energy Commission, ORNL-3077*, Apr. 18, 1961, 96 pp. (UF767 U3o Contin.)

Nuclear Prototype Power Plant Installation in Merchant Ships. An optimum technique having the widest general application is selected. This concept is then applied to a reference 32,790 dwt tanker and gas/superheated steam nuclear power plant, and the concept developed in sufficient detail to yield over-all gross cost estimates and production schedules. *U. S. Atomic Energy Commission, FiCo* 112, Feb. 1960, 192 pp. (UF767 Un3.1f Contin.)

Burst Slug Detection in the AGR. The system developed by Plessey incorporating a matrix system and a new eight-way precipitator. ***David Iggulden.*** *Nuclear Power*, v. 6, May 1961, p. 71-73.

Refuelling the AGR. One of the first two combined-purpose installations to operate on-load anywhere in the world, the charge machine is due for installation in the near future. ***J. Spencer Burkett.*** *Nuclear Power*, v. 6, May 1961, p. 75-77.

Irradiation Techniques for Fissile Materials—5. Techniques developed at Harwell for the high activity handling methods involved in detailed metallurgical examination. ***O. S. Plail.*** *Nuclear Power*, v. 6, May 1961, p. 82-86.

OPERATIONS RESEARCH

Prudent-Manager Forecasting. A new approach to long-range planning puts the manager in the customer's place. ***Gerald A. Busch.*** *Harvard Business Review*, v. 39, no. 3, May-June 1961, p. 57-64.

* **The Managerial Profession.** Throughout the industrial world today, the accent is on professional approaches to management problems such as growth planning and facilities expansion. This is all part of a broad trend toward a new concept of the management professional. ***Vannevar Bush.*** *Industrial Development*, v. 130, no. 4, Apr. 1961, p. 6-9.

* **Making the Engineering Team Click.** The greatest responsibility for success lies with engineering management, its direct policies, and its basic philosophies. ***H. B. Van Dorn.*** *American Engineer*, v. 31, May 1961, p. 27 + 2 pages.

Engineering Management. The alterations which have been made in this edition have been called for in the main by the changes in industrial conditions that have taken place during the 12 or more years since the book was originally written. The basic principles of management, as set out in the first edition, remain unaltered. Some changes in the text have been made, however, in order to put more emphasis on the making of decisions by the executive, as the central act of management. ***Struan A. Robertson.*** 2nd Ed. 467 pp. 1961. Philosophical Library, New York. (HD31 R54e2)

* **The Constrained Gradient Method of Linear Programming.** An efficient algorithm is presented for solving the general linear programming problem whereby, from a point on the boundary of the feasible point set, the "steepest" or "constrained gradient" direction from the point is found. This paper gives an "efficient" procedure for finding the "constrained gradient" at a point and incorporates the procedure into a general method such that optimality is achieved in a finite number of "basis changes". ***C. E. Lemke.*** *Society for Industrial and Applied Mathematics, Journal*, v. 9, no. 1, Mar. 1961, p. 1-17.

* **Characteristics of Optimal Maintenance Policies.** Presents an approach to maintenance planning which utilizes mathematics and economic theory to help select an optimal maintenance condition. The maintenance problem is discussed first with respect to short-run (daily) routine operating decisions, and then with respect to long-run decisions as they relate to

equipment design and to maintenance facilities. ***Robert L. Bovaird.*** *Management Science*, v. 7, no. 3, Apr. 1961, p. 238-253.

Management Sciences. Models and Techniques. Proceedings of the Sixth International Meeting of the Institute of Management Sciences, Conservatoire National des Arts & Metiers, Paris, Sept. 7-11, 1959. ***C. West Churchman and Michel Verhulst, editors.*** v. I. 602 pp.; v. II. 511 pp. 1960. Pergamon Press, New York. (HD29 In7m)

* **Fifo and Lifo Policies in Inventory Management.** Evaluation of FIFO (= first in first out) versus LIFO (= last in first out) policies in stock depletion problems has hitherto been based on the classification of field life functions as convex and concave, the optimal policy for $n>2$ units being determined when the optimal policy for $n = 2$ units is known. This paper suggests a test for selecting the optimal policy for the $n = 2$ system, for field life functions with a derivative equal or larger than -1, and by induction the conclusions are extended to $n>2$. When the derivative is smaller than -1, LIFO is shown to be an optimal policy. ***Samuel Eilon.*** *Management Science*, v. 7, no. 3, Apr. 1961, p. 304-315.

Capital Productivity Appraises Management. Trends in the cash return on operating investment may highlight variations in how well companies use their invested capital. *Chemical & Engineering News*, v. 39, no. 20, May 15, 1961, p. 45-47.

ORE AND MATERIALS BENEFICIATION

* **Anion Exchange of Uranium in Nitrate Solutions.** A study was made of the anion exchange behavior of sexivalent U from concentrated nitrate solutions. Such a process would be particularly desirable in that it would enable the recovery of adsorbed U from the resin as uranyl nitrate, a product having widespread utility for uranium oxide and metal production. ***John M. Googin, Lawrence R. Phillips, and Charles R. Schmitt.*** *Journal of Chemical and Engineering Data*, v. 6, no. 2, Apr. 1961, p. 217-219.

Effect of Particle Size Upon the Green Strength of Iron Oxide Pellets. Correlates the crushing strength of green pellets prepared from magnetite, specular and earthly hematite with the particle size of these respective raw materials. No attempt was made to correlate the strength of fired pellets and particle size. ***R. P. Jewett, C. E. Wood, and J. P. Hansen.*** *U. S. Bureau of Mines Report of Investigations* 5762, 1961, 15 pp. (TN21 Un3r Room 290)

* **Extraction of Uranium From Sulfate Solutions by Tri-n-Octylamine.** Shows that an increase of U concentration in the organic phase causes a decrease of the extraction coefficients of the other cations present in leach liquors. (*In Polish.*) Ekstrakcja uranu z roztworu siarczanów za pomocą trój-*n*-oktyloaminy. ***Czesław Deptuła and Wincenty Korpak.*** *Nukleonika*, v. 5, no. 12, 1960, p. 845-854.

* **The Recovery of Uranium From Leaching Liquors by Solvent Extraction With Dodecyl Phosphoric Acid.** Includes the influence of the organic-phase composition on U and Fe extraction. (*In Polish.*)Wydobywanie uranu z roztworów potrawiennych przez ekstrakcje kwasem dodecylofosforowym. ***Tadeusz S. Urbański.*** *Nukleonika*, v. 5, no. 12, 1960, p. 831-843.

* **Tests for the Recovery of Uranium From Mine Waters by Ion Exchange.** (*In German.*) Versuche zur Gewinnung von Uran aus Grubenwässern mittels lonenaustauscher. ***H. Ziehr.*** *Atomkernenergie*, v. 6, Apr. 1961, p. 162-164.

Orearb Electric Furnace Process for the Direct Reduction of Iron Ore. ***W. R. Braddock.*** *Iron and Steel Engineer*, v. 38, Apr. 1961, p. 123-125.

* **A Mixture of Tantalum and Columbium Pentoxides Produced in Decomposition of Tantalite-Columbite by Means of Fusion With Caustic Potash.** Owing to the technique developed, very pure mixtures of these pentoxides containing 98.7-99.2% Ta_2O_5 + Nb_2O_5 were produced during 71-73% extraction (with no treatment of the waste products). These mix-

tures can be used in producing pure fluorotantalate and fluoroniobate salts or potassium hydroxyfluoroniobate, and also in making Ta-Nb alloys by the electrolytic or carbothermal methods. (*In Russian.*) Poluchenie smesi piatiokisef tantala i niobiia pri vskrytii tantalita-kolumbita splavleniem s edkim kali. ***V. I. Konstantinov.*** *Tsvetnye Metally,* v. 34, no. 4, Apr. 1961, p. 35-38.

Copper Segregation at the Lake Shore Mine. A segregation process to concentrate ores not amenable to conventional flotation concentration or sulfuric acid leach treatment is described. ***G. A. Freeman, Carl Rampacek, and L. G. Evans.*** *Journal of Metals,* v. 13, May 1961, p. 370-372.

Role of Bacteria in the Alteration of Sulfide Minerals. Studies undertaken with the objective of applying bacterial oxidation reactions more effectively for the recovery of Cu from mine waste. ***E. E. Malouf and J. D. Prater.*** *Journal of Metals,* v. 13, May 1961, p. 353-356.

PHYSICS

Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Contains a selection of articles on the theoretical and experimental investigations carried out at the Institute of Atomic Energy of the U.S.S.R. Academy of Sciences between 1951 and 1958 on the problem of the controlled thermonuclear reaction and on the questions of the physics of plasma associated with it. All the articles are previously unpublished. ***M. A. Leontovich, editor.*** 361 pp. 1961. Pergamon Press, New York. (QC786 Ak13.1ftr)

Symposium on Spectroscopy. Contains the 18 papers presented at the Third Pacific Area National Meeting of the American Society for Testing Materials, San Francisco, Calif., Oct. 12-15, 1959. 245 pp. 1960. American Society for Testing Materials, Philadelphia, Penna. (QC451 Am35s)

Crystal-Structure Analysis. Formulates the methods—and the theory underlying these methods—for finding the locations of atoms in crystal cells. Reviews all those steps which must be taken before proceeding with analysis. All essential steps are given detailed consideration. ***Martin J. Buerger.*** 668 pp. 1960. John Wiley & Sons, New York. (QD921 B86c)

* **A High Resolution Ionization α-Spectrometer.** The α-spectrometer described has a high resolving power (instrumental half width of the lines~25 keV) and a high aperture ration (solid angle usable 20÷30% from 4π). Formulas were obtained to determine the half width of the α-line and the value of the displacement of the maximum. The radio-engineering noises were lowered, a half width of these noises up to 16 keV was obtained by selecting the first tube of the amplifier and the conditions of its operations. (*In Russian.*) Ionizatsionnyĭ α-spektrometr s vysokim razresheniem. ***G. E. Kocharov and G. A. Korolev.*** *Akademiia Nauk SSSR, Izvestiia, Seriia Fizicheskaia,* v. 25, no. 2, Jan. 1961, p. 237-256.

* **Collective Oscillations in an Electron Gas of Metallic Density. The Correlation Energy. I-II.** Points out that the subsidiary conditions must be formulated in the form of two sets of operator identities: the first set establishes the Bohm-Pines operators of subsidiary conditions, and the second—the commutators of the extended Hamiltonian and of the first set. ***Jan Śledzik.*** *Acta Physica Polonica,* v. 20, no. 1, 1961, p. 3-42.

Some Thermodynamic Considerations on the Properties of Liquid ^{3}He-^{4}He Mixtures. The stratification curve for liquid ^{3}He-^{4}He mixtures shows a singularity at the junction with the lambda curve as can be seen on the basis of pure thermodynamic considerations. If the lambda curve and the stratification curve meet each other under a finite angle, there is a discontinuity in the slope of the stratification curve and in the specific heat at this point. ***R. De Bruyn Ouboter and J. J. M. Beenakker.*** *Physica,* v. 27, Feb. 1961, p. 219-229.

Propagation in a Plasma. The boundary conditions for a radio signal incident normally on a layer of plasma are discussed. It is shown that 10 different modes must in general propagate in the layer, instead of the usually assumed six.

P. A. Clavier. *Journal of Applied Physics,* v. 32, Apr. 1961, p. 578-582.

* **Gas Separation Processes in A. C. Discharges.** Study of a separation produced by the passage of an A. C. current in a gas mixture, depending on the frequency of the discharge current (50 cy/sec, 400 cy/sec, and 540 k cy/sec), on the dimensions of the discharge tube, on the current intensity, the total gas pressure, the partial pressure of the addition gases and the type of gas. (*In German.*) Gasentmischungsvorgänge in Wechselstromglimmentladungen. ***H. Deutsch.*** *Annalen der Physik,* v. 6, nos. 7-8, Dec. 1960, p. 355-360.

Quantum Mechanical Three-Body Problem. II. Presents a method for treating the quantum mechanical three-body problem. ***Leonard Eyges.*** *Physical Review,* v. 121, 2nd ser., no. 6, Mar. 15, 1961, p. 1744-1757.

Green's Function Method for Quantum Corrections to the Thomas-Fermi Model of the Atom. ***Gene A. Baraff and Sidney Borowitz.*** *Physical Review,* v. 121, 2nd ser., no. 6, Mar. 15, 1961, p. 1704-1713.

* **Experiments With Electrodeless Generation and Acceleration of Plasma Rings.** Plasma rings of comparatively high purity and with velocities up to 5 cm/μs have been produced. ***L. Högberg and K. Vogel.*** *Nuclear Instruments and Methods,* v. 10, Feb. 1961, p. 95-107.

Analogue Method for Computing the Number of Spins Contributing to a Magnetic Resonance Absorption. Since the area under an absorption profile is proportional to the first moment of the algebraic area under its derivative, it may be determined by a simple balance and cardboard cut-outs of the tracing. ***V. R. Burgess.*** *Journal of Scientific Instruments,* v. 38, Mar. 1961, p. 98-99.

Unsteady Motion of Continuous Media. A knowledge of the general premises of this theory is almost indispensable in the science of magnetohydrodynamics, which makes use of the same methods of solving nonlinear partial differential equations. Contains a restatement of classical theory and also a complete account of contributions to gas dynamics by Russian scientists. ***K. P. Stanyukovich.*** 745 pp. 1960. Pergamon Press, New York. (QC168 St24ntr)

* **Stratified-Spiral Growth of Crystals.** A study of the surface of crystals in equilibrium with the surrounding medium, the surface energy of the crystals, the growth of the crystals from vapors, from a solution and from a melt, the reciprocal influence of a growing crystal and the impurities, etching, a statistical approach to the description of collective effects of the displacements of different steps along the surface of a crystal. (*In Russian.*) Sloisto-spiral'nyĭ rost kristallov. ***A. A. Chernov.*** *Uspekhi Fizicheskikh Nauk,* v. 73, no. 2, Feb. 1961, p. 277-331.

Foundations of Electromagnetic Theory. An unusually clearly written and teachable textbook for courses in electricity and magnetism offered on the advanced undergraduate level, particularly suitable for the student with a qualitative understanding of atomic phenomena and a sound background in mathematics. Includes: a full vector treatment of the subject where vector identities simplify proofs of theorems; a rigorous development of electricity and magnetism from experimental laws with no essential proofs relegated to more advanced texts; use of atomic concepts to simplify the understanding of macroscopic theory of fields inside matter; and an introduction to plasma physics. ***John R. Reitz and Frederick J. Milford.*** 387 pp. 1960. Addison-Wesley Publishing Co., Inc., Reading, Mass. (QC670 R27f)

Effect of Long Wavelength Harmonics on Double Crystal Diffractometer Measurements. Shows that large errors due to long wavelength harmonics can occur in the determination of integrated intensities and halfwidths with a double crystal spectrometer. ***Boris W. Batterman.*** *Review of Scientific Instruments,* v. 32, Apr. 1961, p. 393-396.

* **Plasma Oscillations. I.** A review of the theory of wave phenomena in plasmas. The basic kinetic theory is developed taking into account coulomb collisions. From this magnetohydrodynamic equations are derived. It is demonstrated that it is legitimate to deal with a closed subset of these equations either

in the limit of collision-dominated phenomena, or in the limit where the effective phase velocities of the phenomena of interest are much greater than thermal speeds. ***I. B. Bernstein and S. K. Trehan.*** *Nuclear Fusion*, v. 1, no. 1, Sept. 1960, p. 3-41.

Demagnetization of Ferromagnetic Particles. Finely divided magnetic solids show a wide variation in their residual magnetism after passage through an alternating current demagnetizer. High residual magnetism is associated with considerable oscillation of the suspended particles in the alternating magnetic field. ***F. Smith.*** *British Journal of Applied Physics*, v. 12, Apr. 1961, p. 155-159.

Exact Relativistic Fokker-Planck Coefficients for a Plasma. Exact relativistic Fokker-Planck coefficients are obtained by a solution of the first-order coupled integral equations of the particle and oscillator pair correlation functions. ***Albert Simon.*** *Physics of Fluids*, v. 4, no. 5, May 1961, p. 586-599.

Thermodynamics, Statistics, and Information. A short summary of the two principles of thermodynamics, together with the statistical interpretaton of entropy, is given. It is shown that the definition of "information" leads to a direct connection between information and the negative of entropy (abbreviated: negentropy). Every experiment consumes negentropy (increases entropy) and yields information. ***L. Brillouin.*** *American Journal of Physics*, v. 29, no. 5, May 1961, p. 318-328.

Plasma Acceleration. Fourth Lockheed Symposium on magnetohydrodynamics which contains nine papers on recent experimental and theoretical work on magnetohydrodynamics applied to the acceleration of plasma for propulsion for interplanetary travel. Discusses the principal means of accelerating ionized material for propulsion, including pulsed magnetic plasma accelerators and d-c electrostatic ion-electron accelerators. ***Sidney W. Kash, editor.*** 117 pp. 1960. Stanford University Press, Stanford, Calif. (TL783.6 K15p)

* **Electromagnetophoresis.** The theory and description of some possible uses of an electromagnetokinetic phenomenon. The migration of neutral particles and the influence of size, shape and charge of the particle is described. (*In Polish.*) Elektromagnetoforeza. ***Jerzy Kowalczyk and Tadeusz Pompowski.*** *Wiadomosci Chemiczne*, v. 15, Feb. 1961, p. 107-129.

Propagation of Electromagnetic Waves in a Plasma With Strong Magnetic Field. Propagation of plane waves is treated and a wave-theoretical formulation is derived, valid for any wave field under the assumed conditions with a uniform magnetic field. ***H. Poeverlein.*** *Physics of Fluids*, v. 4, no. 4, Apr. 1961, p. 397-405.

An Experimental Study of Continuous Plasma Flows Driven by a Confined Arc in a Transverse Magnetic Field. A crossed-field, continuous-flow plasma accelerator has been built and operated. The highest measured velocity of the flow, which was driven by the interaction of the electric and magnetic fields, was about 500 meters per second. ***R. L. Barger, J. D. Brooks, and W. D. Beasley.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-716, Mar. 1961, 25 pp. (TL570 Un3t Room 290)

* **Nonobservance of Boltzman Distribution in the Process of Thermal Dissociation of Molecules.** (*In Russian.*) O naroshenii Bol'tsmanovskogo paspredeleniia v protsesse termicheskoi dissotsiatsii molecule. ***A. I. Osipov.*** *Akademiia Nauk SSSR, Doklady*, v. 137, no. 4, 1961, p. 833-835.

* **Quantum Mechanical Theory of the Spectra of Absorption and Luminescence of Complex Molecules.** (*In Russian.*) Kvantovo-mekhanicheskaia toriia spektrov pogloshcheniia i liuminestsentsii slozhnykh molecul. ***B. I. Stepanov.*** *Akademiia Nauk SSSR, Doklady*, v. 137, no. 4, 1961, p. 836-839.

Gravitational Waves in General Relativity. V. An Exact Spherical Wave. A construction is given for an exact solution of Einstein's empty space-time field equations representing an axially symmetric pulse wave with the properties that: the wave front is a sphere, outside of which all space-time is flat; a finite, expanding line singularity forms the axial diameter of this sphere. ***L. Marder.*** *Royal Society, Proceedings*, v. 261, Ser. A, Apr. 11, 1961, p. 91-96.

Introduction to Quantum Electrodynamics. Book 1 and Book 2. Considers principally quantum electrodynamics (free field, interaction of photons with electrons and positrons and theory of electron-positron vacuum which is the most thoroughly developed branch of modern quantum field theory. (Translated from *State Publishing House of Physical-Mathematical Literature*, Moscow, 1958.) ***A. A. Sokolov.*** *U. S. Atomic Energy Commission, AEC-tr*-4322, Dec. 1960, 558 pp. (UF767 Un3.1ae Contin.)

The Fermi Surface. Proceedings of an International Conference on Fermi surfaces held at Cooperstown, N. Y., in Aug. 1960. Such topics as the importance of many-body effects in both theory and experiment, the diverse experimental and theoretical information on the noble metals, progress in the understanding of polyvalent metals, and the electronic structure of alloys are given special prominence. ***W. A. Harrison and M. B. Webb, editors.*** 356 pp. 1960. John Wiley & Sons, New York. (QC176 H24f Over.)

* **Magnetohydrodynamic Surface Waves.** In this work are considered nonlinear waves on the plane surface of incompressible, ideally conducting, plasma in presence of an external magnetic field. (*In Russian.*) Magnitogidrodinamicheskie poverkhnostnye volny. ***L. S. Solov'ev.*** *Zhurnal Tekhnicheskoĭ Fiziki*, v. 31, no. 4, Apr. 1961, p. 407-418.

* **Shock Ionization and Detonation in Magnetohydrodynamics.** In this article are determined possible detonation and shock ionization conditions in the magnetohydrodynamic environment. It is claimed that this problem is of interest for certain astrophysic problems. (*In Russian.*) Ob udarnoĭ ionizatsii i detonatsii v magnitnoĭ gidrodinamike. ***V. P. Demutskiĭ and P. V. Polovin.*** *Zhurnal Tekhnicheskoĭ Fiziki*, v. 31, no. 4, Apr. 1961, p. 419-427.

* **Neon, Argon, Helium and Hydrogen Ionization in Pulse Discharge.** (*In Russian.*) Ionizatsiia neona, argona, geliia i vodoroda v impul'snom razriade. ***Iu. D. Pigarov and P. M. Morozov.*** *Zhurnal Tekhnicheskoĭ Fiziki*, v. 31, no. 4, Apr. 1961, p. 476-485.

* **Nitrogen and Oxygen Ionization in Pulse Discharge.** (*In Russian.*) Ionizatsiia azota i kisloroda v impul'snom pazpiade. ***Iu. D. Pigarov and P. M. Morozov.*** *Zhurnal Tekhnicheskoĭ Fiziki*, v. 31, no. 4, Apr. 1961, p. 467-475.

* **Expansion Engine for Liquefaction of Helium.** The unit and its performance are described. (*In Russian.*) Detandernaia ustanovka dlia ozhizheniia geliia. ***P. L. Kapitsa and I. B. Danilov.*** *Zhurnal Tekhnicheskoĭ Fiziki*, v. 31, no. 4, Apr. 1961, p. 486-494.

* **General Theory of Van der Waals Forces.** (*In Russian.*) Obshchaia teoriia Van-der-Vaal'sovykh sil. ***I. E. Dzialoshinskiĭ, E. M. Lifshits, and L. P. Pitaevskiĭ.*** *Uspekhi Fizicheskikh Nauk*, v. 73, no. 3, Mar. 1961, p. 381-422.

* **A Contribution to the Three-Body Problem of Quantum Mechanics. I. Basic Principles. II. Nonlinear Three-Atomic Molecules.** The above has been treated in appropriate co-ordinates, viz., the distances between the three particles and three Eulerian angles, fixing in space the position of the triangle formed by the particles. (*In German.*) Zum quantenmechanischen Dreikörperproblem. I. Grundlagen. II. Nichtlineare dreiatomige Moleküle. I. ***H. Diehl, S. Flügge, U. Schröder, A. Völkel, and A. Weiguny.*** II. ***S. Flügge and A. Weiguny.*** *Zeitschrift für Physik*, v. 162, no. 1, 1961, p. 1-20.

* **Influence of Magnetic Field on the Shape of Boundary of Penetrating Plasma and Its Focusing.** The magnetic field can improve or worsen the plasma focusing, depending on the configuration of the boundary referred to. There should be an outlet of the plasma through openings away from the source axis. (*In Russian.*) Vliianie magnitnogo polia na formu granitsy pronikaiushcheĭ plazmy i plasmennuiu fokusirovku. ***M. B. Gabovich and L. I. Romaniuk.*** *Zhurnal Tekhnicheskoĭ Fiziki*, v. 31, no. 3, Mar. 1961, p. 315-320.

Blanc's Law—Ion Mobilities in Helium-Neon Mixtures. Studies permit the investigation of ion motion in gases, e.g., He^+ in Ne, under conditions where the charge transfer interaction is negligible compared to polarization attraction and short-range repulsion between ion and atom. ***Manfred A. Biondi and Lorne M. Chanin.*** *Physical Review*, v. 122, 2nd ser., no. 3, May 1, 1961, p. 843-847.

* **A Contribution to the Study of the Propagation of Longitudinal Ultrasonic Waves in Heterogeneous Media.** In iron ore the parameters influencing the absorption process directly were studied at ultrasonic frequencies of 1.5 M c/s and 50 kc/s. In mortars, measurement at 1.1 M c/s during hardening shows that absorption depends upon the mechanical properties of the material, especially the resistance to simple compression. In steel at 2.4 and 6 M c/s, absorption increases considerably when the structure element reaches the order of magnitude of half the wavelength of the ultrasounds in the material. Calculation under special conditions confirmed this experiment. (*In French.*) Contribution a l'étude de la propagation des ondes ultrasonores longitudinales dans les milieux hétérogènes. ***Marie-Louise Gaulard.*** *Annales de Physique*, v. 6, ser. 13, nos. 3-4, Mar.-Apr. 1961, p. 427-466 + 2 plates.

The Size of Atomic Electron Shells as a Function of Atomic Number. The dependence on the atomic number and degree of ionization of an atom is discussed. On the basis of the function investigated, relative values are calculated for the rare earth ions with k = −3, +1, +2, +4, and +6. The results are compared with the experimental data. ***V. S. Korol'kov.*** *Optics and Spectroscopy* (Cover-to-cover translation of *Optika i Spektroskopiia*), v. 10, no. 1, Jan. 1961, p. 1-3.

The Toroidal Apparatus With a Strong Magnetic Field "Tokomak-2". Special construction features of an apparatus to investigate the Joule heating of the plasma in a strong longitudinal magnetic field are described. ***V. S. Vasil'evskii, V. S. Mukhovatov, V. S. Strelkov, and N. A. Yavlinskii.*** *U. S. Atomic Energy Commission, AEC-tr-*4188, Apr. 1961, 17 pp. (UF767 Un3.1ae Contin.)

Magnetic Trap With Rotating Plugs. If electromagnetic oscillations of large amplitudes are excited in a plasma, filling the trap with static magnetic plugs, then an additional force, which opposes the escape of particles from the trap, will act on the plasma particles in the region of the plugs. It is shown that in this manner we can close the escape cone of the particles. ***L. I. Rudakov.*** *U. S. Atomic Energy Commission, AEC-tr-*4280, Apr. 1961, 12 pp. (UF767 Un3.1ae Contin.)

PLASTICS

* **Electrical Resistivity of Polymers.** Measurements of the temperature dependence of volume resistivity of a variety of polymers are used to elucidate polymer structure and the mechanism of electrical conduction. ***R. W. Warfield and M. C. Petree.*** *SPE Transactions*, v. 1, no. 2, Apr. 1961, p. 80-85.

Reduction of Polymers Using Complex Metal Hydrides. II. A study of the reaction between acylating and alkylating agents and the reaction mixtures obtained from the reduction of simple ketones and esters with complex metal hydrides is described. Pure poly(allyl alcohol) was prepared by the reduction of poly(methyl acrylate) with lithium aluminum hydride using sodium potassium tartrate in the isolation procedure. A number of other ester-containing vinyl polymers were also reduced with lithium aluminum hydride, acetylated directly, and then hydrolyzed to the pure hydroxyl-containing polymers. These polymers were also reduced with lithium borohydride. In these cases, acetylation was not required for product isolation. ***H. L. Cohen, D. G. Borden, and L. M. Minsk.*** *Journal of Organic Chemistry*, v. 26, Apr. 1961, p. 1274-1278.

* **Polymerization of Vinyl Chloride. Molecular Weight Distribution of Polyvinyl Chloride During the Suspension Process.** The molecular weight distribution curves of six samples of polyvinyl chloride taken during a suspension polymerization were determined. The degrees of conversion of the samples varied from 4% up to 94%. Fractionations of the samples were carried out in the system tetrahydrofuran-water by fractional precipitation. It appears that the molecular weight distribution does not substantially vary in the course of the polymerization. The experimental results are discussed. ***G. Pezzin, G. Talamini, and G. Vidotto.*** *Makromolekulare Chemie*, v. 43, nos. 1-2, Mar. 1961, p. 12-22.

* **Block Copolymers From a Dihydroperoxide. II. The Emulsion Polymerization Stage.** As the third stage of the block copolymer synthesis, hydroperoxide-ended polystyrenes have been treated with ferrous ions and methyl methacrylate in aqueous emulsion at temperatures between 0 and 25 C; the products of the reactions were shown, by the weight increases and by infrared analyses, to contain polymethyl methacrylate in amounts of the same or twice the weight of the starting polystyrenes. ***P. Molyneux.*** *Makromolekulare Chemie*, v. 43, nos. 1-2, Mar. 1961, p. 31-60.

* **Polymerization of Ketene and Diketene.** In the presence of boron trifluoride ketene or diketene gave an amorphous polymer. Its molecular weight was not very high. Several evidences indicate that the polymer mainly consists of the β-diketone structure. ***Ryohei Oda, Sunao Munemiya, and Masaya Okano.*** *Makromolekulare Chemie*, v. 43, nos. 1-2, Mar. 1961, p. 149-151.

* **Radiation and Natural Rubber Latex.** Irradiation improved the storage property of the latex. This was particularly significant with deammoniated latex. As the dose increased, the latex darkened. Properties of the irradiated latex were studied. Foam rubber produced from irradiated latex exhibited improved compression and stock efficiency. Tensile strength and elongation were slightly decreased and volume shrinkage of molded foam stock was increased. The threshold dose for observing such changes was about one megarad. ***T. C. Gregson, T. H. Rogers, L. B. Bangs, and D. W. Peabody.*** *Rubber Age*, v. 89, no. 1, Apr. 1961, p. 81-87.

New Polymer Blend Upgrades PVC. By combining chlorinated polyethylene with rigid PVC, a polymer is developed with better low-temperature impact strength and better processability than straight rigid polyvinyl chloride. This plastic resin is available in three grades of hardness. Properties of each grade are given. *Modern Plastics*, v. 38, no. 8, Apr. 1961, p. 94 + 2 pages.

* **Effect of Impurities on Polyethylene Adhesion.** The peeling strength of an aluminum foil glued to a glass plate with "adhesionable" polyethylene was lowered by incorporating oleic acid into polyethylene. The average thickness τ of the organic film remaining on the aluminum after peeling was a few microns for pure polyethylene, near 20μ for a mixture of polyethylene 99.6 and oleic acid 0.4 parts, and very small (for instance, 0.5μ) for a mixture of polyethylene 97 and oleic acid 3 parts. In grossly contaminated polyethylenes, rupture occurred in a weak boundary layer and τ depended on location and extent of these layers. ***J. J. Bikerman.*** *Journal of Applied Chemistry*, v. 11, Mar. 1961, p. 81-85.

* **Polyoxymethylenes.** A review on the historical development of polyoxymethylenes is followed by a report on the authors' own investigations. During the polymerization of trioxane or formaldehyde, started with the aid of ionic initiators, in the presence of suitable carriers stable end groups can be built in. Trioxane or monomeric formaldehyde can be copolymerized with some cyclic compounds and with some vinyl compounds. Further, well known and new reactions at the hydroxylic end groups of polyoxymethylene dihydrates are described, by means of which it is possible to prepare thermically and chemically stable polyoxymethylenes. Finally, the degradation of polyoxymethylenes is dealt with. (*In German.*) Polyoxymethylene. ***Werner Kern, H. Cherdron, and V. Jaacks.*** *Angewandte Chemie*, v. 73, no. 6, Mar. 21, 1961, p. 177-186.

* **Mechanism of Emulsion Polymerization of Vinylidene Chloride. I. II. Effect of Coalescence of Polymer Particles on Kinetics. III. Effects of Stirring Rate on Kinetics.** I. ***Peter M. Hay, et al.*** II. ***John C. Light, Leon Marker, Anthony T. Santonicola, and Orville J. Sweeting.*** III. ***Charles P. Evans, et al.*** *Journal of Applied Polymer Science*, v. 5, no. 13, Jan.-Feb. 1961, p. 23-47.

Effect of Infrared Heat on 45° Tensile Strength of Two Reinforced Phenolic Laminates. The study was conducted on tensile coupons from phenolic laminates made with either glass fabric or asbestos fibers and machined at 45° to the natural axes. The results of the first series, in which the temperature of the coupons was increased on the surface at a constant rate before loading, show the characteristic drop in strength with increases in temperature from air heating and a slightly greater drop in strength with infrared heating. The results of the second series in which the coupons were partially loaded and then heated with infrared on only one side at various rates from 1 to 29 F per second until failure occurred, showed that

the hot-side temperature increased with increasing rate of temperature rise; furthermore the center temperature (average of hot and cold side) was relatively unaffected by rate of temperature rise. It therefore appears that thermal shock and subsequent thermal gradient did not produce small internal fractures in these phenolic coupons. ***Kenneth H. Boller.*** *U. S. Forest Products Laboratory Report No.* 1879, Mar. 1961, 9 pp. (TS800 Un3.3r Contin.)

POLLUTION AND WASTES

Technical Progress Report. Air Quality of Los Angeles County. A data-packed historical accounting of the efforts which have been made over the last ten years to understand and control the air pollution of Los Angeles County. ***Janet E. Dickinson.*** v. II. 290 pp. 1961. Los Angeles County Air Pollution Control District, Los Angeles, Calif. (TD884 L89t)

* **Automative Exhausts: Pollution and Control.** A seminar report. *Archives of Environmental Health,* v. 2, no. 5, May 1961, p. 559-574.

* **Air Pollution Control in a Typical Eastern City.** Sources of pollution, meteorology and topography, health and nuisance aspects, and future growth. *Archives of Environmental Health,* v. 2, no. 5, May 1961, p. 545-558.

Pilot-Plant Studies in Production of Sulphur From Sulphate-Enriched Sewage Sludge. The process originated by the National Chemical Laboratory for microbiological production of sulfur from sulfate-enriched sewage sludge, has been successfully carried out on a pilot-plant scale (50 gal.). ***S. G. Burgess and L. B. Wood.*** *Journal of the Science of Food and Agriculture,* v. 12, Apr. 1961, p. 326-335.

* **Dispersion and Effects of Air Borne Fluorides in Central Florida.** ***E. R. Hendrickson.*** *Air Pollution Control Association, Journal,* v. 11, no. 5, May 1961, p. 220-225.

* **A Simplified Method for Characterizing a Motor Vehicle's Exhaust Emissions.** Technique involves the collection of all of the automobile exhaust gases in an evacuated plastic bag. Subsequent measurements of the composition and volume of this total sample can be accomplished using any available laboratory measuring technique. Plastic bags of Mylar film were shown to result in no change in hydrocarbon, carbon monoxide, or carbon dioxide concentrations for one hour after bag filling. Plastic bags made of polyethylene are considered usable if measurements are made immediately after filling the bag. ***A. M. Smith and J. H. Struck.*** *Air Pollution Control Association, Journal,* v. 11, no. 5, May 1961, p. 251 + 3 pages.

* **Effects of Chromium on the Activated Sludge Process.** Results show that, short of massive slug doses, chromate alone is unlikely to harm the operation of a sound sewage treatment plant. Concentrations of hexavalent chromium of up to 0.5 mg/l were almost completely removed under conditions of the study. At 2.0-mg/l feed, hexavalent chromium was occasionally found in small quantities in the effluent. With the 5.0-mg/l and higher chromate feeds, variable but increasing fractions of the chromium passed through the system to emerge as either hexavalent or reduced chromium in the effluent. ***W. Allan Moore, G. N. McDermott, Mildred A. Post, J. W. Mandia, and M. B. Ettinger.*** *Water Pollution Control Federation, Journal,* v. 33, Jan. 1961, p. 54-72.

* **The Formation of Magnetic Iron Sulphide by Bacterial Reduction of Iron Solutions.** Laboratory scale experiments have been carried out with sulfate-reducing bacteria growing under anaerobic conditions to investigate the removal of Fe from Fe-containing solutions. The complete removal of Fe, as the insoluble sulfide, has been achieved from both ferrous and ferrous-ferric sulfate solutions. It has been found that under certain conditions a magnetic iron sulfide is produced. This aggregates under the influence of a magnetic field and settles at a rate of some 30 in./min. The magnetic sulfide has only been obtained from intermittent continuous cultures. With the system employed, rates of removal of up to 150 mg of iron per liter of culture vessel per hour have been obtained. ***Anthony M. Freke and Donald Tate.*** *Journal of Biochemical and Microbiological Technology and Engineering,* v. 3, no. 1, Apr. 1961, p. 29-39.

* **Cation Exchangers on a Sugar-Beet Pulp Base. Application for Decontaminating Radioactive Waste Water.** By treating sugar-beet pulp with formaldehyde and hydrochloric acid, the amount of water bound to the pulp is very much decreased. By this treatment a cation exchanger is produced having a capacity per unit volume about six times greater than that of sugar-beet pulp. The capacity of this exchanger is about 0.5 mg eq. per gram of dry matter. The selective behavior of sugar-beet pulp treated with formaldehyde is similar to that of unmodified sugar-beet pulp. ***W. Th. J. P. Langenhorst, M. Tels, J. C. Vlugter, and H. I. Waterman.*** *Journal of Biochemical and Microbiological Technology and Engineering,* v. 3, no. 1, Apr. 1961, p. 7-20.

Proceedings of the Fifteenth Industrial Waste Conference, May 3, 4, and 5, 1960 Sponsored by School of Civil Engineering and Division of Sanitary Engineering, Purdue University and the Division of Sanitary Engineering, Indiana State Board of Health. *Industrial Waste Conference, Proceedings, 15th Conference,* 1960, 624 pp. (TD897 In2p Vis.)

* **Scrubbing of Fume From Combustion Gases at Efficiencies Up to 99.98 Percent.** In the study of the capabilities and limitations of the water scrubbing system for the removal of fume, a number of operating conditions were independently varied to determine the effect of each on collection efficiency of the scrubbing system. These variables were saturating water-air ratio, sub-cooler water-air ratio, mass flow rate of air, fuel-air ratio, hot-gas velocity at which initial precooling and saturation occurred, direction of subcooler nozzles, subcooler-nozzle water pressures, and residence time of the fume between the saturator and the subcooler. ***Glen M. Hein and Alexander R. Orban.*** *Air Pollution Control Association, Journal,* v. 11, no. 5, May 1961, p. 205-219.

* **Parameters of Aerometric Measurements for Air Pollution Research.** A brief description of a continuous gas-sampling network is presented in which a number of air pollutants is to be measured in six United States cities beginning about mid-1961. Six equations are developed to depict the frequency, duration, and air-pollution dosage. ***Ralph I. Larsen.*** *American Industrial Hygiene Association Journal,* v. 22, no. 2, Apr. 1961, p. 97-101.

RELIABILITY ENGINEERING

* **Reliability Problems of High Frequency Equipment.** The theory of isochronism is used to reveal the most important quantitative relations characterizing the reliability of high frequency equipment. The description includes technical and operational indexes. (*In German.*) Zum Problem der Betriebssicherheit hochfrequenztechnischer Geräte. ***G. W. Denisow and N. M. Sedjakin.*** *Nachrichtentechnik,* v. 11, no. 3, Mar. 1961, p. 125-130.

* **The Reliability of Mechanical Parts in Data Processing Systems.** An extensive informal discussion. *Chartered Mechanical Engineer,* v. 8, no. 4, Apr. 1961, p. 228-233.

The Effect of the NOL and Battelle Data Interchange Programs on Librascope Reliability Test Efforts. Describes the different aspects and the mechanics of each program. The NOL Program is for the use of Fleet Ballistic Missile Weapons System (FBMWS) contractors and the Battelle Program is funded by contributions of the members. ***Leonard G. Rado.*** *IRE Transactions on Reliability and Quality Control,* v. RQC-10, Mar. 1961, p. 26-28. (TK1 In6.6q Vis.)

RUBBER AND ELASTOMERS

Effects of Nuclear Radiation on Rubber. This discussion provides insight into basic effects of radiation. It further shows how radiation effects can be used to advantage (as beneficial effects), defines radiation damage to rubber in terms of stress-strain and dynamic mechanical properties, and indicates how to partially inhibit such detrimental effects in rubber polymers and products. ***John W. Born.*** *Materials Research & Standards,* v. 1, Apr. 1961, p. 280-286.

* **Effect of Gel and Structure on the Properties of *Cis*-1-4 Polyisoprene.** Synthetic *cis*-1,4 polyisoprene made so as to have high molecular weight, relatively loose gel, and not over 5% 3,4 structure equals *Hevea* rubber in both raw and vulcanizate properties. ***C. F. Gibbs, S. E. Horne, Jr., J. H. Macey, and H. Tucker.*** *Rubber World*, v. 144, no. 1, Apr. 1961, p. 69 + 6 pages.

* **Self-Bonding Silicone Rubber.** The introduction of a bonding grade of silicone rubber that will bond ferrous metals with an adhesive force stronger than the material itself, promises to be a boon to mechanical rubber fabricators who make such items as oil seals, shock mounts, rubber-covered rolls, or other specialty products. ***R. P. DeSieno.*** *Rubber World*, v. 144, no. 1, Apr. 1961, p. 75 + 1 page.

* **Hydrogenation of Sodium-Polybutadiene.** During this process in a solution with a nickel kieselguhr catalyst, the highest effect on the depth of hydrogenation shows the relationship of rubber to the catalyst. Between 60 and 140 C, hydrogenation is not accompanied with cyclization. The external double bonds in Na-polybutadiene are hydrated rather than the internal. (*In Russian.*) Gidrogenizatsiia natriĭ-polibutadiena. ***A. I. Iakubchik, B. I. Tikhomirov, and L. N. Mikhailova.*** *Zhurnal Prikladnoĭ Khimii*, v. 34, no. 3, Mar. 1961, p. 652-655.

* **Sorption of Binary Solutions by Butadiene-Nitrile Copolymers.** A study was made of the sorption of binary systems of the type of solvent–polar nonsolvent (benzene–aliphatic alcohols) and solvent–nonpolar nonsolvent (aromatic hydrocarbons–aliphatic hydrocarbons) by butadiene-nitrile rubber vulcanizates containing 18.26 and 40% acrylonitrile. It was shown that in systems in which the polar nonsolvent takes part, the sorption potential of the solvent diminishes with increasing concentration of the nitrile groups in the polymer, whereas the contrary is true for the nonpolar nonsolvent. A thermodynamic interpretation of the phenomena is given. The nitrile copolymers were shown to be highly suitable for separating aromatic and aliphatic hydrocarbon mixtures. The separation efficiency increases with increase in the nitrile content of the copolymer and molecular weight of the aliphatic hydrocarbon. (*In Russian.*) Sorbtsiia binarnykh rastvorov butadiennitrĭl'nymi sodolimerami. ***G. L. Starobinets and V. F. Tikaryĭ.*** *Kolloidnyĭ Zhurnal*, v. 23, no. 1, Jan.-Feb. 1961, p. 112-117.

How Good Are Environmental Tests for Elastomers. Types of tests available for measuring environmental deterioration of elastomers, and an indication of how useful the results of such tests are in predicting service performance. Effects of high and low temperatures, aging, ozone and corona, and fluids, are discussed. *Materials in Design Engineering*, v. 53, no. 4, Apr. 1961, p. 124-127.

Rubber and Tire Friction. An attempt is made to relate the friction characteristics of a rubber block to those of a slipping and sliding pneumatic tire. Several new or modified explanations for the behavior of tires on dry and wet surfaces are proposed. The effects of pressure or normal load, sliding velocity, temperature, and contaminating and lubricating films on the adhesion and hysteresis components are separately investigated for the rubber block and the rolling, slipping, and sliding tire. ***H. W. Kummer and W. E. Meyer.*** *Pennsylvania State University, Engineering Research Bulletin B-80*, Dec. 1960, 96 pp. (TI P38b Vis.)

New Elastomeric Polyethylene for Low Temperature Flexibility. The composition of the new copolymer has not been disclosed. It is designated DPDB-6169. The chemical, physical, and mechanical properties are compared to low-density polyethylene and to flexible PVC. *Materials in Design Engineering*, v. 53, no. 5, May 1961, p. 14-15.

* **Preparation and Properties of Aqueous Dispersions of Synthetic and Natural Rubber Vulcanizates.** Dispersion during mastication by incorporating an oleophilic emulsifier in the rubber and subsequently converting it into a water soluble product by saponification led to the formation of finer dispersions than by the use of aqueous soap solutions. The highest dispersion is achieved with resin on its saponification with aqueous caustic alkali solutions. (*In Russian.*) Poluchenie i svoĭstva vodnykh dispersiĭ vulkanizovannogo kauchuka i reziny. ***B. A. Dogadkin, G. N. Zachesova, and I. A. Shokhin.*** *Kolloidnyĭ Zhurnal*, v. 23, no. 2, Mar.-Apr. 1961, p. 150-156.

a * **Infrared Spectroscopic Studies of Ultrathin Microtomed Sections of Polymers. II. Characterization of Both Fillers and Rubbers in Cured Rubbers Loaded With Inorganic Fillers.** Many cured, black-loaded rubbers contain varying amounts of inorganic fillers: to characterize the rubber, absorptions due to fillers must be recognized and identified. Reference spectra of all the common inorganic fillers used in the rubber industry have been recorded and their recognition in infrared spectra of ultra-thin microtomed sections of known and unknown samples is described. Both rubbers and inorganic fillers b can usually be identified in cured samples. ***P. J. Corish.*** *Journal of Applied Polymer Science*, v. 5, no. 13, Jan.-Feb. 1961, p. 53-57.

* **Physical and Technological Properties of *cis* Polybutadiene.** Polybutadiene obtained with soluble cobalt catalysts having a high cis-1,4 content and controlled molecular weight shows better properties than other polybutadienes. ***G. Natta, G. Crespi, G. Guzzetta, S. Leghissa, and F. Sabbioni.*** *Rubber and Plastics Age*, v. 42, Apr. 1961, p. 402 + 6 pages.

SOLID MECHANICS

d * **Investigations on the Stress in Circular Shaft Linings.** Measurement of stress in the linings of several vertical shafts, recently sunk in coal mines, by means of a photoelastic stress-meter, and data for estimating the earth pressure that may act on shaft linings when they are sunk into ground of various conditions. ***Yoshio Hiramatsu, Yukitoshi Oka, and Shōji Ogino.*** *Kyoto University, Memoirs of the Faculty of Engineering*, v. 23, pt. 1, Jan. 1961, p. 90-110.

e **The Electron Microscope...A New Tool for Examining Fractures.** Fracture surfaces of metals can now be examined at magnifications up to 50,000X by the electron microscope. This technique, termed "electron microfractography", may become an important tool in failure analysis; it promises to reveal many of the heretofore undisclosed details associated with the various failure phenomena. ***Austin Phillips and Guy V. Bennett.*** *Metal Progress*, v. 79, no. 5, May 1961, p. 97-102.

f * **Mechanical Properties of Materials at High Temperature.** Discusses recent research on creep, rupture, and fatigue under complex stress systems. ***A. I. Smith.*** *Chartered Mechanical Engineer*, v. 8, no. 5, May 1961, p. 278-285.

g **Brittle Fracture Strength of Welded Steel Plates. Tests on Five Further Steels.** The results of tensile tests on 60 steel plates, each 3 ft wide and 1 in. thick, are described. A mild steel, a semi-killed higher manganese low-carbon steel, and three fully-killed normalized steels were tested. The samples were artificially notched in edges prepared for butt welding, which was carried out along the plate centers in the direction of tension. At the temperatures chosen for test, many brittle fractures were obtained at externally applied loads well below yield-point value, and in 12 of those cases fractures passed h through the plates without arrest. ***A. A. Wells.*** *British Welding Journal*, v. 8, May 1961, p. 259-277.

Some Design Considerations for Welded Aluminium. The characteristics of various aluminum alloys are described, and comparisons are made with structural steel. Typical applications are given. Static and fatigue strength of welded aluminum joints, and some preferred details of construction, are discussed. ***S. R. Banks and R. E. Smith.*** *British Welding Journal*, v. 8, May 1961, p. 199-206.

j **A Design Guide Preventing Fatigue Failures. II. Geometric Stress Concentrations.** Stress concentration factors for predicting fatigue failures; ways of minimizing stress-concentrators. ***F. B. Stulen, H. N. Cummings, and W. C. Schulte.*** *Machine Design*, v. 33, May 11, 1961, p. 191-195.

k * **Linear Theory of Non-Uniform Torsion.** St. Venant's solution of the torsion problem applies only to cases where the cross-sections all warp in the same manner and by the same amount. This paper gives the solution for the cases where warping varies, either because there is a cross-section where there is a restraint on deformation or because the applied torque varies along the bar. The solution is restricted to small deflections such that the principle of superposition may be applied. ***S. J. McMinn.*** *Journal of Mechanical Engineering Science*, v. 3, no. 1, Mar. 1961, p. 80-88.

Effect Upon Shock Spectra of the Dynamic Reaction of Structures. Overconservatism in design resulting from incorrect usage of shock spectra is verified by a series of controlled shock experiments in the laboratory. ***George J. O'Hara.*** *Experimental Mechanics,* v. 1, May 1961, p. 145-151.

Stresses at Nozzle Connections of Pressure Vessels. The presence of a nozzle in a pressure vessel creates a region of increased localized stress in the vicinity of the opening. The techniques and methods used in analyzing three insert-type nozzles when loaded by internal pressure are reported and discussed. ***Donald E. Hardenbergh.*** *Experimental Mechanics,* v. 1, May 1961, p. 152-158.

SOLID STATE PHYSICS

*** Hall Effect of Layers Condensed During Annealing of the Tin-Copper System.** Electrical resistance, the transition temperature of superconductivity, and the Hall coefficient of the films were measured immediately after condensation, during annealing to about 350 K, and recooling to He temperatures. (*In German.*) Hall-Effekt abschreckend kondensierter Schichten des Systems Zinn-Kupfer. ***Joachim Fortmann and Werner Buckel.*** *Zeitschrift für Physik,* v. 162, no. 1, 1961, p. 93-104.

Preparation and Properties of Grown P-N Junctions of InSb. Grown p-n junctions of InSb were produced by doping high-purity n-type melts with zinc. The crystals were oriented such that the growth axes of the crystals were perpendicular to a (111) plane. The effects of anisotropic distribution of impurities within the crystals were observed in the electrical properties of the diodes. The lifetime of minority carriers at high injection levels (forward bias) was observed. Anomalous values are attributed to changes in properties of the bulk material rather than the surface. The curves of current density as a function of temperature showed leakage currents to predominate at lower temperatures and saturation currents to predominate at higher temperatures. This observation was verified by current-voltage profiles at appropriate temperatures. ***H. C. Gorton, A. R. Zacaroli, F. J. Reid, and C. S. Peet.*** *Electrochemical Society, Journal,* v. 108, Apr. 1961, p. 354-356.

Chemical Etching of Silicon. III. A Temperature Study in the Acid System. The etch rate of silicon in solutions of various compositions selected from the system HF, HNO_3, H_2O, and $HC_2H_3O_2$ has been investigated over the temperature range of 0 to 50 C. ***B. Schwartz and H. Robbins.*** *Electrochemical Society, Journal,* v. 108, Apr. 1961, p. 365-372.

*** Electrical and Optical Properties of $CdSnAs_2$.** Above have been investigated for samples having carrier concentrations between 1 and 3 x $10^{18}cm^{-3}$. Resistivity and Hall coefficient measurements yield room-temperature electron Hall mobilities between 6200 and 5500 cm^2/V-sec in this carrier concentration range. ***W. G. Spitzer, J. H. Wernick, and R. Wolfe.*** *Solid State Electronics,* v. 2, nos. 2-3, Mar. 1961, p. 96-99.

*** An Analysis of the Performance of Thermoelectric Devices Made From Long-Lifetime Semiconductors.** An upper limit to the efficiency of this device is shown to be inferior to that of a conventional (zero-lifetime) thermoelement. ***R. N. Hall.*** *Solid State Electronics,* v. 2, nos. 2-3, Mar. 1961, p. 115-122.

*** Photorectifier Based on a Combination of a Photoconductor and an Electret.** The mechanism of the rectification is discussed with reference to the mechanism of photocurrents through powdered CdS layers. A cross-bar system based on this new type of photorectifier has been constructed. ***J. G. van Santen and G. Diemer.*** *Solid State Electronics,* v. 2, nos. 2-3, Mar. 1961, p. 149-156.

Cyclotron Resonance in Indium Antimonide at High Magnetic Fields. Energy levels are calculated for a carrier in a band in the presence of a magnetic field and which is interacting with neighboring bands. ***B. Lax, J. G. Mavroides, H. J. Zeiger, and R. J. Keyes.*** *Physical Review,* v. 122, 2nd ser., no. 1, Apr. 1, 1961, p. 31-35.

Energy Release in Reactor-Irradiated Copper. II. 600° to 700°K Release. Above was measured utilizing nuclear heating. ***T. H. Blewitt, S. T. Sekula, and J. Diehl.*** *Physical Review,* v. 122, 2nd ser., no. 1, Apr. 1, 1961, p. 53-57.

Designing Low-Current Thermoelectric Coolers. ***R. M. Jepson and G. G. Messick.*** *Electronics,* v. 34, no. 16, Apr. 21, 1961, p. 58-60.

Optical Ranging System Uses Laser Transmitter. Coherent light beam derived from ruby maser provides ranging capability up to two or three miles. System transmits with an angular beamwidth of one minute of arc. ***M. L. Stitch, E. J. Woodbury, and J. H. Morse.*** *Electronics,* v. 34, no. 16, Apr. 21, 1961, p. 51-53.

Chemical Firms Push Organic Research as Ticket to Semiconductor Market. Lists promising features. *Electronics,* v. 34, no. 16, Apr. 21, 1961, p. 22.

Photoconductivity of CdS-Type Photoconductors in the Vicinity of the Absorption Edge. In this model, the photocurrent is assumed to arise mainly through the excitation of electrons from discrete levels very close to the valence band and the trapped holes formed in this process are in an excited state. ***N. N. Winogradoff.*** *Journal of Applied Physics,* v. 32, Mar. 1961, p. 506-509.

Field Solution for a Thin-Film Superconducting Strip Transmission Line. By using Londons' equations, the two-fluid model, and the classical skin effect for the normal component of the current, a sinusoidal wave solution is found for a superconducting transmission line. ***James C. Swihart.*** *Journal of Applied Physics,* v. 32, Mar. 1961, p. 461-469.

Tunnel Diode Applications. The tunnel diodes' basic circuit simplicity, high-speed operation, and various methods of combining them with transistors are illustrated and described. ***C. D. Todd.*** *Electrical Engineering,* v. 80, Apr. 1961, p. 265-271.

The Optical Maser. The only maser as a device for light-beam communication. ***C. G. B. Garrett.*** *Electrical Engineering,* v. 80, Apr. 1961, p. 248-251.

*** Propagation Along Unbounded and Bounded Dielectric Rods. I. Propagation Along an Unbounded Dielectric Rod.** A method for evaluating the propagation coefficients of an unbounded lossless dielectric rod of infinite extent. ***P. J. B. Clarricoats.*** *Institution of Electrical Engineers, Proceedings,* v. 108, pt. C, no. 13, Mar. 1961, p. 170-176.

Synthesis Using Tunnel Diodes and Masers. Use of modern synthesis techniques for realizing prescribed frequency characteristics by amplifier networks that contain tunnel diodes or masers is described. ***Louis Weinberg.*** *IRE Transactions on Circuit Theory,* v. CT-8, no. 1, Mar. 1961, p. 66-75.

Plastic Crystals and Rotation in the Solid State. Subject of a symposium held in the Inorganic Chemistry Laboratory, Oxford University, Apr. 5-6, 1960. Contains 17 papers. *Physics and Chemistry of Solids,* v. 18, no. 1, Jan. 1961, 92 pp.

Time Decrease of Magnetic Permeability in Some Mixed Ferrites. Decrease after demagnetization, or disaccommodation, was measured for Mn-Zn, Ni-Zn, Cu-Zn and Mg-Zn ceramic ferrites. Considerable disaccommodation was observed with samples containing Fe_2O_3 over the stoichiometric composition. ***Keizo Ohta.*** *Physical Society of Japan, Journal,* v. 16, Feb. 1961, p. 250-258.

Electric Conduction of Ferrites Containing Fe^{2+}-Ions. The D.C. electric conductivity was measured between 100 K and 300 K for the ferrite solid solution $(MeFe_2O_4)_{1-y}$-$(Fe_3O_4)_y$, where Me = Mn, Ni, Mn-Ni or Zn. ***Nahonori Miyata.*** *Physical Society of Japan, Journal,* v. 16, Feb. 1961, p. 206-208.

Cross-Relaxation Masers. Surveys available ways of using ruby, spinel, rutile and emerald in masers which amplify at frequencies small compared to their zero-field splitting frequencies. Particular attention is paid to means of taking advantage of cross relaxation. ***G. S. Bogle.*** *I.R.E. Proceedings,* v. 49, Mar. 1961, p. 573-590.

Diffusion in Metals. A comprehensive bibliography. The study of defects in pure metals has become one of the most active areas of research in metallurgy and solid state physics. ***P. G. Shewmon and G. R. Love.*** *Industrial and Engineering Chemistry,* v. 53, Apr. 1961, p. 325-328.

Line Shape of Proton Magnetic Resonance in Paramagnetic Solids. Investigates the influence of paramagnetic ions on the second moment or mean-square width of the proton magnetic resonance line in solids. ***D. J. Kroon.*** *Philips Research Reports,* v. 15, no. 6, Dec. 1960, p. 501-583.

* **Thermal Fluctuation Effects in Thin Magnetic Films.** Above is interpreted quantitatively on the basis of the theory of thermal fluctuation effects, and values of the anisotropy field and mean effective crystallite size are deduced and discussed. ***E. P. Wohlfarth.*** *Journal of Electronics and Control,* v. 10, no. 1, Jan. 1961, p. 33-37.

* **On the Validity of Treating a Dense Plasma as a Metal in Radio-Frequency Containment of Plasmas.** The $TM_{1,0,0}$ mode is solved for a cylindrical resonator with plasma and metal walls, the plasma being treated formally as a dielectric. ***F. B. Knox.*** *Journal of Electronics and Control,* v. 10, no. 1, Jan. 1961, p. 1-11.

* **Macroscopic Physics of Surface Recombination in Semiconductors.** An improved model in which the excess charge carrier lifetime is supposed to vary with position is analyzed, and it is found that the apparent recombination velocity can depend markedly on the experimental conditions when the diffusion length is short as with indium antimonide. ***A. C. Sim.*** *Journal of Electronics and Control,* v. 10, no. 2, Feb. 1961, p. 117-126.

A Solid-State Microwave Source From Reactance-Diode Harmonic Generators. An approximate solution for the conversion loss of harmonic generators utilizing these devices has been obtained and design curves relating conversion loss with harmonic number, diode Q, and voltage-capacitance coefficient are presented. ***T. M. Hyltin and K. L. Kotzebue.*** *IRE Transactions on Microwave Theory and Techniques,* v. MTT-9, no. 1, Jan. 1961, p. 73-78.

Confocal Multimode Resonator for Millimeter Through Optical Wavelength Masers. A resonator consisting of two identical concave spherical reflectors, separated by any distance up to twice their common radius of curvature, is considered. ***G. D. Boyd and J. P. Gordon.*** *Bell System Technical Journal,* v. 40, no. 2, Mar. 1961, p. 489-508.

* **Methods of Producing Stable Transistors.** Shows necessity of producing surface conditions that will minimize changes. ***J. J. A. Ploos van Amstel.*** *Philips Technical Review,* v. 22, no. 6, 1960-1961, p. 204-214.

* **Solid-State Research at Low Temperatures. I. Introduction.** The first of three papers on solid-state research at low temperatures, shows by a number of examples that a system may be said to be at a low temperature when kT is smaller than a certain characteristic energy. ***J. Volger.*** *Philips Technical Review,* v. 22, no. 6, 1960-1961, p. 190-195.

On the Power Transfer Between Paramagnetic Spins and Crystal Lattice II. Measurements are in CrK-alum, at liquid He and H temperatures, by steady-state saturation of the microwave absorption at 9400 MC. ***B. Bölger, J. M. Noothoven Van Goor, and K. J. Van Damme.*** *Physica,* v. 27, Jan. 1961, p. 18-32.

Research Breakthroughs in Optical Masers and Superconductors. The practical use of optical masers and superconducting electromagnets has been solved. *Bell Laboratories Record,* v. 39, Mar. 1961, p. 83-86.

Optical Masers and Micrography. Presents first photomicrograph ever taken using beam from an optical maser as a light source. ***J. S. Courtney-Pratt.*** *Bell Laboratories Record,* v. 39, Apr. 1961, p. 142-143.

A Low-Noise X-Band Radiometer Using Maser. Uses a ruby maser preamplifier in radio astronomy measurements and a reflection-cavity maser with voltage-gain bandwidth products as high as 300 Mc at 4.2 K. ***J. J. Cook, L. G. Cross, M. E. Bair, and R. W. Terhune.*** *I.R.E. Proceedings,* v. 49, Apr. 1961, p. 768-778.

a * **A Certain Group of Ternary Semiconducting Compounds.** Alloys corresponding to the formula of a ternary compound $B^{II}B^{IV}_2B^{VI}_3$, where B^{II} is Cu, B^{IV} is Ge, Sn, Pb; B^{VI} is S, Se, Te, were synthesized. Deciphering by X-rays taken in Cu rays permits to infer that in each case, except in alloys with Pb, ternary compounds with a diamond lattice are formed. "Superstructural" radiographic lines were found in low amount with Cu_5GeSe_3. (*In Russian.*) Ob odnoĭ gruppe troĭnykh poluprovodnikovykh coedineniĭ. ***L. S. Palatnik, Iu. F. Komnik, V. M. Koshkin, and E. K. Belova.*** *Akademiia Nauk SSSR, Doklady,* v. 137, no. 1, Mar.-Apr. 1961, p. 68-71 + 1 plate.

b **The Thermomagnetic Behaviour of Cobalt Ferrite.** A new method of analysis of the results is described which appears to give useful information when applied to materials of less complex magnetic behavior. ***L. F. Bates and A. J. Pacey.*** *Physical Society, Proceedings,* v. 77, pt. 3, Mar. 1961, p. 567-575.

c * **Dielectric Relaxation Processes in Selenium.** Measurements of the frequency and temperature dependency of the dielectric losses of polycrystalline Se variously doped with Br exhibit a behavior typical for abnormal dispersion. This behavior was discussed with the assumption of displacement processes between potential holes having energetically the same or different depths. (*In German.*) Dielektrische Relaxationserscheinungen an Selen. ***W. Ludwig and F. Eckart.*** *Zeitschrift für Physik,* v. 162, no. 2, 1961, p. 127-141.

d * **The Magnetic Properties of Very Thin Iron Evaporation Layers in a Vacuum and Their Change Under Access of Air.** The magnetization of thin Fe layers equals the value of the compact material with layer thicknesses as low as 30 Å. The thickness function appears first after admission of air. The coercive force of the layers changes also. The variations of the magnetic properties are terminated before the apparatus is fully aired. The measurements taken right after removing the layers from the vacuum are not valid for the pure layers in a vacuum. (*In German.*) Die magnetischen Eigenschaften dünnster Eisenaufdampfschichten in Vakuum und ihre Änderung beim Luftzutritt. ***Horst Hoffmann.*** *Zeitschrift für Angewandte Physik,* v. 13, no. 3, Mar. 1961, p. 149-151.

e **Superconducting Transition in Zinc and Gallium.** Transitions have been studied to compare the supercooling of these elements with that shown by Al under similar conditions. ***John F. Cochran and D. E. Mapother.*** *Physical Review,* v. 121, 2nd ser., no. 6, Mar. 15, 1961, p. 1688-1692.

f **Experiments on the Angular Momentum of a Supercurrent and the Possibility of a Supercurrent Gyroscope.** Shows experimentally that the direction of the angular momentum of a circulating supercurrent remains fixed relative to the body in which the current flows. ***A. C. Rose-Innes and G. M. Taylor.*** *American Journal of Physics,* v. 29, no. 4, Apr. 1961, p. 268-271.

g **Solid-State Parallel-Mode Scanner Reads System Physical Parameters.** Monitor system handles parameters that can be converted to a change of electrical resistance. A diode array checks the maximum or minimum values of input signal; by replacing the diodes with transistors, source of signal being displayed can easily be identified. ***S. Thaler.*** *Electronics,* v. 34, no. 19, May 12, 1961, p. 78-80.

h **Current Flow Across Grain Boundaries in *n*-Type Germanium. I-II.** In the temperature range where carrier generation in the space charge region can be neglected and for donor concentrations in the bulk larger than $10^{14}/cm^3$, the current is carried essentially by electrons crossing the barrier, the zero bias conductance is independent of the donor concentration. ***R. K. Mueller.*** *Journal of Applied Physics,* v. 32, Apr. 1961, p. 635-645.

i **Surface Electrical Changes Caused by the Adsorption of Hydrogen and Oxygen on Silicon.** ***J. T. Law.*** *Journal of Applied Physics,* v. 32, Apr. 1961, p. 600-609.

j **Galvanomagnetic Effects in *n*-Ge in the Impurity Conduction Range.** ***R. J. Sladek and R. W. Keyes.*** *Physical Review,* v. 122, 2nd ser., no. 2, Apr. 15, 1961, p. 437-442.

k

Galvanomagnetic Properties of *n*-Type $CdAs_2$. Results indicate the surfaces of constant energy to be ellipsoids of revolution, located along the symmetry axis of the crystal system. ***A. S. Fischler.*** *Physical Review*, v. 122, 2nd ser., no. 2, Apr. 15, 1961, p. 425-429.

Cooling Transistors With Beryllia Heat Sinks. Ceramic has advantages over other heat sink materials. It insulates electrically, conducts thermally. Beryllia has a number of properties that combine to make it an excellent transistor heat sink material. Describes a series of tests run on beryllia heat sinks. ***K. H. McPhee.*** *Electronics*, v. 34, no. 18, May 5, 1961, p. 76-78.

* **Optical Orientation of Atoms and Its Applications.** Review. (*In Russian.*) Opticheskaia orientatsiia atomov i ee primeneniia. ***G. V. Skrotskii and T. G. Iziumova.*** *Uspekhi Fizicheskikh Nauk*, v. 73, no. 3, Mar. 1961, p. 423-470.

* **Antiferromagnetic Properties of Cobaltous Oxide.** The magnetic susceptibility of CoO was studied between 100 and 700 K. A sharp peak was detected at 292 K. The dependence of the susceptibility on the field in the antiferromagnetic state in the region of the antiferromagnetic Curie point is established. (*In Russian.*) Antiferromagnitnye svoistva zakisi kobal'ta. ***V. I. Chechernikov and V. G. Kol'chenko.*** *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki*, v. 40, no. 3, Mar. 1961, p. 721-724.

* **Transition From an Antiferromagnetic State to a Weakly Ferromagnetic State in a Magnetic Field.** The dependence of the magnetic moment on temperature and field strength is studied in detail for various crystallographic directions in anhydrous cobalt sulfate. For the c axis the temperature dependence has been derived for the critical field at which the transition from the antiferromagnetic state to the ferromagnetic occurs. In order to explain the anomalous magnetic properties observed in $CoSo_4$ and previously in $CuSO_4$, an analysis is carried out of the thermodynamic potential for the D_{2h}^{19} symmetry group to which the investigated compounds belong. A qualitative explanation of the strong growth of the susceptibility anisotropy near T_N for $T > T_N$ and also of the anomalously large magnitude of $X\|$ below T_N is presented. ***N. M. Kreines.*** *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki*, v. 40, no. 3, Mar. 1961, p. 762-774.

* **A Contribution to the Study of Infrared Emission in Germanium.** Studies the infrared emission due to the radiation transitions of the holes between two branches of the valence band of Ge. A new parasitic effect usable in measuring the absorption by minor carriers was revealed. The optical properties of high purity Ge were studied. The Ge-Sn alloy has a limit of absorption of about 0.2 eV. A new semiconductor was suggested. Several new types of infrared luminescence were found in Ge. (*In French.*) Contribution a l'étude de l'émission infrarouge dans le germanium. ***Jacques I. Pankove.*** *Annales de Physique*, v. 6, ser. 13, nos. 3-4, Mar.-Apr. 1961, p. 331-374.

* **Magneto-Optical Properties of Ferrite-Garnets in the Infrared Region.** The Faraday effect in infrared light was measured in yttrium and holmium ferrite-garnets at room temperature and at the temperature of liquid nitrogen. The Faraday effect in holmium garnet changes sign on passing through the compensation point, this being a consequence of rotation of the spin system in the magnetic field. An absorption band due to electric transitions between levels of the ground term of the holmium ions, $5\bar{7}8 \rightarrow 5\bar{7}7$ has been detected by optical and magneto-optical methods at $\lambda = 1.96\mu$. (*In Russian.*) Magnitooptichesie svoistva ferritov-granatov v infrakrasnoi oblasti. ***G. S. Krinchik and M. V. Chotkin.*** *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki*, v. 40, no. 3, Mar. 1961, p. 729-733.

Photochemistry of the V_1 Center. A series of photochemical experiments on the color centers present in KBr and KCl after exposure to X-rays at 80 K is discussed. These experiments are chemical in nature with the reactions being triggered through exposure to radiation of various wavelengths. ***J. D. Kingsley.*** *Physical Review*, v. 122, 2nd ser., no. 3, May 1, 1961, p. 772-778.

Low-Temperature Lattice Thermal Conductivity. The effect of point imperfections is discussed with particular attention to the case in which the temperature is low but the normal three-phonon scattering is still dominant. ***Joseph Calloway.*** *Physical Review*, v. 122, 2nd ser., no. 3, May 1, 1961, p. 787-790.

The Magnitude of the Anharmonic Contribution to the Static Dielectric Constant. Shows that in ionic crystals the anharmonic contribution to the static dielectric constant can be calculated above the Debye temperature if the derivatives of the dielectric constant with respect to temperature and pressure are known. ***B. Szigeti.*** *Royal Society, Proceedings*, v. 261, ser. A, Apr. 25, 1961, p. 274-280.

The Search for New Semiconductors. Recent discoveries of noncrystalline semiconductors, including liquids, and of inorganic semiconductors. ***B. R. Pamplin.*** *New Scientist*, v. 10, Apr. 13, 1961, p. 46-48.

* **A Contribution to the Detection of Thin Surface Layers on Single Copper Crystals (An Investigation With Electron Interference).** Thin surface layers on the (100)-plane of a Cu crystal were examined with electron interferences in reflection due to electrolytic polish of the crystal in phosphoric acid and by evaporation with Fe, Pd and Ni. The layers consist of an atom layer it seems, as is shown by gradual removal by means of cathode atomizing and evaporation with a molecular beam of known intensity. (*In German.*) Zum Nachweis sehr dünner Oberflächenschichten auf Kupfereinkristallen (Eine Untersuchung mit Elektroneninterferenzen). ***O. Haase.*** *Zeitschrift für Naturforschung*, v. 16a, Feb. 1961, p. 206-208.

* **Optical Properties of Absorbing Magnetic Crystals. I. Round Optical Axes. Monoclinic Syngony Crystals.** On the basis of the invariant dyad representation of the tensor $\gamma' = \epsilon'^{-1}\mu$ the conditions of existence in absorbing magnetic crystals of round optical axes were studied. A classification of monoclinic crystals according to their properties was made. (*In Russian.*) Opticheskie svoĭstva pogloshchaiushchikh magnitnykh kristallov. I. Krugovye opticheskie osi. Kristally monoklinnoĭ singonii. ***L. M. Tomil'chik.*** *Kristallografiia*, v. 6, no. 1, 1961, p. 61-66.

* **Calculation of the Internal Electrical Fields in the Perovskite Crystal ($CaTiO_3$).** An important difference was found in the distribution of the fields in $CaTiO_3$ and in its related ferroelectric crystals ABO_3. The authors discussed the possibility to explain the presence or absence of anomalies in the dielectrical properties of the ABO_3 compounds by the deformation of the BO_3 octahedra. (*In Russian.*) Raschet vnutrennikh elektricheskikh poleĭ v kristalle perovskita ($CaTiO_3$). ***S. P. Solov'ev, Iu. N. Venevtsev, G. S. Zhdanov, and V. V. Ivanova.*** *Kristallografiia*, v. 6, no. 1, 1961, p. 78-85.

* **Functional Relationship Between the Direction of Incidence and the Scintillation Light Yield of Thin Anthracene and Stilbene Crystals Bombarded With α-Particles.** A strong dependence of the light yield on the direction of incidence with respect to the crystal axes is found, confirming the results of previous measurements with thick anthracene crystals. (*In German.*) Die Richtungsabhängigkeit der Szintillations-Lichtausbeute von dünnen Anthrazen- und Stilben-Kristallen beim Beschuss mit α-Strahlen. ***P. H. Heckmann, H. Hansen, and A. Flammersfeld.*** *Zeitschrift für Physik*, v. 162, no. 1, 1961, p. 84-92.

* **Magnetic-Optical Resonance in Nickel at Ultraviolet Frequencies.** Measurements are taken in the U.V. region up to 2480 Å. Resonance with a (4.7 ± 0.2) ev transition energy was observed, which coincides with the data obtained by the X-ray method of the characteristic losses of energy of the electrons. The resonance was caused either by electron s-d transitions or by plasma vibrations of free electrons. (*In Russian.*) Magnitoopricheskiĭ rezonans v nikele na ul'trafioletovykh chastotakh. ***G. S. Krinchik and A. A. Gorbachev.*** *Fizika Metallov i Metallovedenie*, v. 11, no. 2, Feb. 1961, p. 203-206.

* **The Emitting of Photoelectrons Under the Action of Soft γ-Rays.** The entire coefficient of emission of photoelectrons from thick photocathodes of Al, Ag, Ta and W for 4-9 kev X-rays was measured. A dependency of the coefficients of emission of the photoelectrons on the energy of the X-ray energy and on the angle of incidence on the photocathode was obtained. (*In Russian.*) Vykhod fotoelektronov dlia miagkikh rentgenovskikh luchei. ***A. S. Ganeev and I. M. Izrailev.*** *Zhurnal Tekhnicheskoi Fiziki*, v. 31, no. 3, Mar. 1961, p. 376-382.

* **Complex Conductivity of Some Plasmas and Semiconductors.** Above is calculated for several cases where the collision frequency can be expressed as a power function of the energy. ***P. H. Fang.*** *Applied Scientific Research, Sec. B, Electrophysics, Acoustics, Optics, Mathematical Methods*, v. 9, no. 1, 1961, p. 51-64.

Nuclear Quadrupole Resonance in an Antiferromagnet. Behavior is attributed to the combined effects of an antiferromagnetic ordering of the Ni^{++} electron spins and a hfs interaction of the nonlocalized Ni^{++} spin magnetization with the I^{127} nuclear magnetic moment. ***J. C. Burgiel, V. Jaccarino, and A. L. Schawlow.*** *Physical Review*, v. 122, 2nd ser., no. 2, Apr. 15, 1961, p. 429-436.

* **Effect of the Neighboring Elements of Iron on the Hall Effect of Iron-Rich Solid Solutions.** In solid solution series of Fe the positive Hall constant R_0 is constantly increased by low additions of the neighboring elements. The change of R_0 produced by 1 at.% foreign metal increases from Co to Cu in a sequence of increasing ordinal numbers linearly. Between Mn and Ti R_0 increases also in a sequence (decreasing in this case) of ordinal numbers. The increase is not strictly linear. Si influences R_0 slightly more than Ti. Al has a higher effect than Si. (*In German.*) Ausleuchtung von Kristallphosphoren mit Ultraschall nach Vorbestrahlung mit UV-Licht und β-Strahlen. ***Klaus Friedrich.*** *Annalen der Physik*, v. 7, nos. 3-4, Jan. 1961, p. 201-209.

* **Absorption and Photochemistry of AgCl Crystals With Bivalent Cation and Anion Additions.** The divalent cations of these crystals produce a change of the optical absorption at −185 C as compared with AgCl crystals with Ag_2S or Ag_2Se doping. Thus as a rule the optical absorption bands shift by 0.05 eV up to 0.15 eV approximately. Photochemically such solid solutions at low temperatures ($T < -150$ C) are almost sensitive. A photochemical coloration is obtained only from about −130 C. These processes were explained. (*In German.*) Absorption und Photochemie von AgCl-Kristallen mit zweiwertigen Kationen- und Anionenzusätzen. ***A. Scholz.*** *Annalen der Physik*, v. 7, nos. 3-4, Jan. 1961, p. 179-188.

* **Present State of the Exciton Problem.** A critical review of the general ideas on excitons and their recent evolution. Special attention is given on the case of semiconductors of the CdS, Si, and Ge type. (*In French.*) État actuel du problème de l'exciton. ***M. Balkanski.*** *Journal de Physique et le Radium*, v. 22, no. 2, Feb. 1961, p. 113-117.

* **Detection of High Energy γ-Rays by Plastic Phosphors.** Finds that for measuring high energy γ-rays in some cases plastic phosphors can be used instead of NaI(Tl) crystals. ***L. Keszthelyi, I. Berkes, I. Demeter, and I. Fodor.*** *Nuclear Instruments and Methods*, v. 10, Mar. 1961, p. 193-201.

Long-Range Order in Fe-Al Alloys. II. Thermoelectric Power. The thermoelectric power relative to Cu has been measured in Fe-Al alloys: for the alloy 25.05 at.% Al over the temperature range 100-950 C, and at room temperature over the composition range 17.0-28.5 at.% Al as a function of quenching temperature. ***G. Erez and P. S. Rudman.*** *Physics and Chemistry of Solids*, v. 18, no. 4, Mar. 1961 p. 307-315.

SPACE HEATING AND CONDITIONING

* **Experimental Study of the Intermittent Vapour Absorption Refrigeration Cycle Employing the Refrigerant-Absorbent Systems of Ammonia Water and Ammonia Lithium Nitrate.** Describes the actual cycle, and the differences between the actual and theoretical cycles and traces together the effects of these differences on the values of the co-efficient of performance and the effective cooling per lb of initial mass of the solution. ***J. C. V. Chinnappa.*** *Solar Energy*, v. 5, no. 1, Jan.-Mar. 1961, p. 1-18.

Infra-Red Warms 'All Outdoors'. Gives examples of current use of infrared gas radiant heaters in certain outdoor areas. *American Gas Association Monthly*, v. 43, no. 4, Apr. 1961, p. 19.

Industrial Ventilation. A Manual of Recommended Practice. 6th Ed. Sections individually paged. 1961. American Conference of Governmental Industrial Hygienists, Committee on Industrial Ventilation, Lansing, Mich. (TH7684.F2 Am35i6 Over.)

Transactions. American Society of Heating, Refrigerating and Air-Conditioning Engineers. v. LXVI. 522 pp. 1961. The American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., New York. (TH7201 Am35t Vis.)

* **How Much Insulation for Pipes and Flat Surfaces?** A practical means for specifying the exact thickness of thermal insulation for maximum economy was developed at the College of Engnieering, West Virginia University, in cooperation with and under the sponsorship of Union Carbide Chemicals Company. The procedure is embodied in a Manuel on Economic Thickness of Insulation for Flat Surfaces and Pipes. Those parts of the Manual most useful to ACH & V readers will be reproduced, starting with this issue. ***C. A. Arents and H. M. Cather.*** *Air Conditioning, Heating and Ventilating*, v. 58, May 1961, p. 65-80.

* **Gas Turbines Provide Electricity, Heating and Cooling.** Great opportunities for the gas turbine lie ahead, the author believes, in generating power within the building and recovering waste heat for steam-operated absorption refrigeration units. ***I. E. Rowe.*** *Air Conditioning, Heating and Ventilating*, v. 58, May 1961, p. 55-59.

Careful Heating-Cooling Design Keeps TV Station "On-the-Air". Describes the heating and air conditioning systems which meet the specialized and stringent demands of the high internal heat gain problem within operating television studio and transmitter buildings. The system developed for WWL-TV in New Orleans has worked well for over three years and has resulted in only minor suggestions for improvements. ***Joseph E. Leininger.*** *Heating, Piping & Air Conditioning*, v. 33, May 1961, p. 131-134.

Radiant Heating Permits 90 F Temperature Drop, Allows Use of Low-Temperature, Low-Pressure Boilers. Describes economical system installed in a large public housing project in Chicago. *Heating, Piping & Air Conditioning*, v. 33, May 1961, p. 115-118.

Install Year 'Round System While Tenants' Work Goes On. Research building gets central air conditioning. *Heating, Piping & Air Conditioning*, v. 33, May 1961 p. 150-152.

* **Ship 'N Shore Gets 59% More Production.** A total investment of 2.8 cents per manhour for cooling equipment brought a 59% incerase in production at Ship 'N Shore's Upland, Penna., plant. ***Eugene A. Sloane.*** *Air Engineering*, v. 3, no. 5, May 1961, p. 26 + 2 pages.

* **Protection of Buildings From Solar Heat.** Stresses necessity of giving attention to the orientation and type of building construction, to the sizes of windows and to the design of façades, as otherwise it will subsequently be found necessary to make unsatisfactory compromises. ***Friedrich Tonne.*** *Institution of Heating and Ventilating Engineers*, v. 29, Apr. 1961, p. 16-23.

* **Utilisation of Waste Heat Gases for Site Heating at the National Gas Turbine Establishment, Pyestock, Farnborough, Hants.** Records the salient features of an installation considered to be unique insofar as it was one of the projects laid down by the British Government after the war to obtain research and technical data on gas turbine work in the industrial field and the first to utilize waste heat gases for site heating. ***P. M. Warrell.*** *Institution of Heating and Ventilating Engineers*, v. 29, Apr. 1961, p. 1-15.

TEXTILES, FIBERS, LEATHER, AND PAPER

* **Recent Theoretical Work in the Area of Sheet Formation.** The author suggests that paper sheet formation is governed predominantly by the interaction between the drainage

force, directed normal to the plane of the wire, and the forces of fluid turbulence, directed parallel to the plane of the wire. ***Joseph D. Parker.*** *Tappi*, v. 44, Apr. 1961, p. 162A-167A.

* **Dimensional Stabilization of Paper by Acetylation.** ***Alfred J. Stamm and Jerry N. Beasley.*** *Tappi*, v. 44, Apr. 1961, p. 271-275.

* **The Influence of Bacteria on Depilation of Hides by Enzymes.** Of a number of disinfectants studied, several were found to control bacterial growth at concentrations which were not harmful to the hair-loosening enzymes. Although the unhairing solutions were not sterilized, there was no apparent damage to the hide, no putrid odor, and no change in the unhairing action, if the bacterial population was kept under about 100 million per ml. ***Theone C. Cordon, A. L. Everett, and W. Windus,*** *American Leather Chemists Association, Journal*, v. 56, Apr. 1961, p. 164-173.

* **The Role of Spiral Structure in Untreated and Treated Cottons.** A reversing spirality represents an idealized structure for obtaining optimum strength, elongation, and elastic recovery from the straight-chain molecules of cellulose. Friction between growth layers and fibrils in such a structure is suggested as a possible cause for permanent set, low intrinsic strength of highly oriented cotton, and the weak points near their reversals. Differences between properties of cotton are reduced but not eliminated by mercerization and resin treatment. ***Rollin S. Orr, Albert W. Burgis, Lloyd B. DeLuca, and James N. Grant.*** *Textile Research Journal*, v. 31, Apr. 1961, p. 302-310.

* **Studies on the Cross-Linking of Cotton Cellulose. II. Microscopical Observations.** ***Verne W. Tripp, Anna T. Moore, and Mary L. Rollins.*** *Textile Research Journal*, v. 31, Apr. 1961, p. 295-301.

* **The Use of Polyacrylamides in Paper Making.** Adding polyacrylamides to paper pulp permits increase in the speed of machines, in the efficiency of fabrication and in certain qualities of the sheets obtained. Raw material, such as titanium oxide and cellulose, is spared to advantage. (*In French.*) L'utilisation des polyacrylamides dans la fabrication du papier. ***Marcel Chêne and Odette Martin-Borret.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 252, no. 15, Apr. 10, 1961, p. 2253-2255.

* **Flocculation at Sedimentation. IV. Application of the Smoluchowski Coagulation Equation.** Tests of this equation were carried out using paper-making fibers sedimenting in water-glycerol mixtures. The effects of particle concentration, particle size, density and viscosity of the suspending liquid were studied and appeared to influence the rate of agglomeration according to the theory. Measurements of the state of agglomeration were carried out by means of direct counting of agglomerates and measurement of the optical nonuniformity of the suspensions. ***Olle Andersson.*** *Svensk Papperstidning*, v. 64, no. 7, Apr. 15, 1961, p. 248-261.

THERMAL MECHANICS

* **The Bristol Siddeley BS-75 Ducted Fan Engine.** Description of the first high by-pass ratio engine to be designed as such from the start. The ducted fan cycle has a by-pass ratio of 1.75:1 and a thrust of 7000 to 8000 lb. *British Aircraft Industry, Bulletin*, Apr. 1961, p. 14-18.

Ignition of Solid Propellant Rocket Motors by Injection of Hypergolic Fluids. A preliminary experimental investigation was conducted to determine the feasibility of igniting solid-propellant motors with hypergolic fluids. Ignition was accomplished by injecting a fluid into the propellant port, which upon contact reacted spontaneously with the fuel component of the propellant, providing sufficient heat for ignition and sustained reaction between the fuel binder and oxidizer. Motors containing composite and double-base propellant were ignited in this manner. Chlorine trifluoride was found to be the most effective ignition fluid. ***Carl C. Ciepluch, Harrison Allen, Jr., and Edward A. Fletcher.*** *ARS Journal*, v. 31, Apr. 1961, p. 514-518.

* **Nomogram Analysis of Heat Transfer in Supersonic Flow.** A method facilitating the calculation of equilibrium and transient surface temperatures for a turbulent boundary layer. ***J. Seddon.*** *Aircraft Engineering*, v. 33, May 1961, p. 124-130.

Importance of Combustion Chamber Geometry in High Frequency Oscillations in Rocket Motors. Two rocket motors having different diameters and several different lengths were employed in the experiments using a gaseous hydrocarbon fuel and air as propellants. The investigation indicated that changes in the aspect ratio and volume of the rocket-motor combustion chamber had a profound effect on the incidence and amplitude of the transverse modes. These effects were modified by interactions of the transverse modes with the longitudinal mode. The transverse modes present in the experiments were determined to be the "spinning" and the radial modes. ***J. R. Osborn and J. M. Bonnell.*** *ARS Journal*, v. 31, Apr. 1961, p. 482-486.

Flow and Heat Transfer Characteristics of Finned Tube Exchangers. Concludes that surfaces having separated and unseparated flow have comparable heat-transfer rates, but separation results in much higher flow losses. ***B. Gebhart.*** *ASHRAE Journal*, v. 3, May 1961, p. 63-69.

* **Why Do Engines Fail?** With over 1000 diesel engines in the field that operate at one of two speeds—idle or full-load—this company set up a plan to find out the specific causes in order to prevent their occurrence. ***Dwain Christian.*** *Diesel Power*, v. 39, May 1961, p. 18-21.

WELDING AND JOINING

Furnace Brazing of Stainless Steel Assemblies. Furnace brazing—employing a variety of protective atmospheres, furnaces and filler metals—offers a number of advantages. Many flux-free, nonporous joints can be brazed simultaneously and economically, dissimilar metals with wide thickness variations can be joined, and close tolerances can be held. ***H. M. Webber.*** *Metal Progress*, v. 79, no. 5, May 1961, p. 108 + 9 pages.

Devolpment of Mig Welding Techniques for Aluminium. Reviews the development of inert-gas metal-arc welding equipment, practice, and standards as applied to aluminum. Emphasis is laid on the fundamentals on which present techniques are based and attention is drawn to the value of scrupulous and thoughtful attention to a number of practical details. ***J. E. Tomlinson and D. Slater.*** *British Welding Journal*, v. 8, May 1961, p. 216-226.

A Recent Specification for Fusion Welded Aluminium and Aluminium Alloy Pressure Vessels for Class I Duties. ***F. Smith.*** *British Welding Journal*, v. 8, May 1961, p. 207-215.

MISCELLANEOUS

* **An Out-of-Kilter Method for Minimal-Cost Flow Problems.** A method of solving minimal-cost network flow problems is described and shown to have a certain desirable monotone behavior. ***D. R. Fulkerson.*** *Society for Industrial and Applied Mathematics, Journal*, v. 9, no. 1, Mar. 1961, p. 18-27.

* **Finite-Difference Techniques for a Boundary Problem With an Eigenvalue in a Boundary Condition.** A mixed boundary-value problem of elliptic type is considered in which the boundary conditions contain an eigenvalue. This problem is motivated by the investigation of small fluid oscillations in an axially symmetric tank. ***Louis W. Ehrlich, James D. Riley, W. Gilbert Strang, and B. Andreas Troesch.*** *Society for Industrial and Applied Mathematics, Journal*, v. 9, no. 1, Mar. 1961, p. 149-164.

A Scientific Approach to the Street Congestion Problem. To talk of a "traffic problem" is to over-simplify. The disease is much more complex, and the basic remedy—which in the author's view is the provision of urban motorways to arrest the decay of city centers—requires collaboration between architect, town planner and civil engineer, plus public good will. ***W. Fisher Cassie.*** *New Scientist*, v. 9, Apr. 6, 1961, p. 857-859.